Burkina Faso
Geographic Institute of Burkina Faso

Digital Topographic Mapping Project in Burkina Faso

(Technical Cooperation for Development Planning)

Final Report

Summary

August 2014

Japan International Cooperation Agency

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A baobab tree near the Office of the President in Ouaga 2000

“For the future!!”

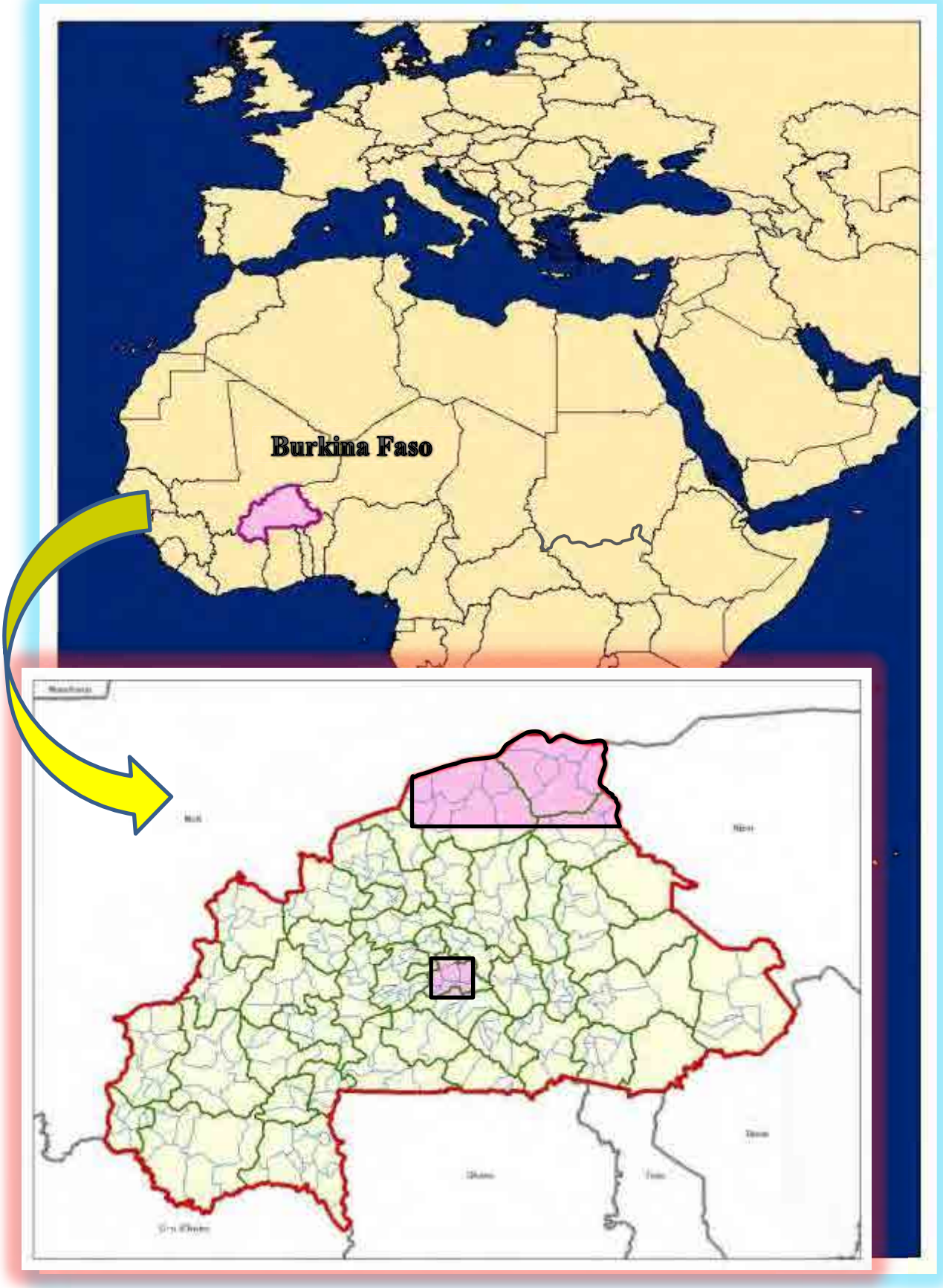
“Pour l'avenir!!”

“A map is better than a thousand words!!”

“Une carte vaut mieux que mille mots!!”

IGB

Study Area



Photos taken in Burkina Faso

IGB building

Signing the Inception Report

Discussion about field identification in Burkina Faso

Discussion about specifications

Vehicles for study with a winch

Guidance on GNSS observation
(using GNSS equipment owned by IGB)

Guidance on leveling observation by a team member by a team member

Ground control point pricking work (GCP03)

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Participants in 1st UEMOA technical seminar for wide-area collaboration

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1st UEMOA technical seminar for wide-area collaboration: Representatives of Burkina Faso, Senegal and organaizers

Pupils studying a map in the Lecture Tour

Team Leader of the JICA Study Team interviewed during the Lecture Tour

2nd UEMOA technical seminar for wide-area collaboration: Representatives of JICA, Embassy of Japan, Ministry of Transport and IGB

2nd UEMOA technical seminar for wide-area collaboration: Closing address by His Excellency, Ambassador Plenipotentiary of Japan, Mr. Futaishi

Participants in 2nd UEMOA technical seminar for wide-area collaboration: 8 UEMOA member countries and Guinea, JICA and JICA Study Team

Abbreviations

No.	Abbreviation	Description	
1	ALOS	ALOS (Advanced Land Observing Satellite "Daichi")	
2	AVNIR-2	Advanced Visible and Near Infrared Radiometer type 2	Advanced visible and near infrared radiometer installed on the ALOS: It can create multipurpose color images using a total of four wavelength bands, *i.e.* blue, green, red and near-infrared.
3	BDOT	Base de Données d'Occupation des Terres	Land Occupation Database
4	BFTM	Burkina Faso Transverse Mercator	
5	BNDT	Base Nationale de Données Topographiques	National Topographic Database
6	BUMIGEB	General Directorate of Mining, Geology and Quarries	
7	BUNASOLS	National Institute of Soil	
8	CCD	Charge Coupled Device	Charged coupled device, a type of solid state image sensor
9	DCIME/CONNED	Division of Capacity Development, Information and Environmental Monitoring/National Council for Environment and Sustainable Development	
10	DEES/ MEDD	Department of Environmental Economics and Statistics/Ministry of Environment and Sustainable Development	
11	DEM	Digital Elevation Model	
12	DGN	Design File	A CAD file format supported by MicroStation
13	2iE	International Institute of Water Environmental Engineering	
14	DWG	Drawing File	A drawing data file format supported by Autodesk.
15	DXF	Drawing Exchange Format	A file format for drawing data created with CAD software
16	EU	European Union	
17	ECOWAS	Economic Community of West African States (Communauté économique des États de l'Afrique de l'Ouest)	
18	FAO	Food and Agriculture Organization	
19	FCFA	Franc Communauté française d'Afrique	Common currency unit used in many West African countries
20	GCP	Ground Control Point	
21	GIS	Geographic Information System	
22	GLONASS	Global Navigation Satellite System	
23	GNI	Gross National Income	
24	GNSS	Global Navigation Satellite System	
25	GPS	Global Positioning System	
26	GRS	Geodetic Reference System 1980	One of the reference ellipsoids constituting the World Geodetic System
27	HDD	Hard Disk Drive	
28	IGB	Institut Géographique du Burkina	Geographic Institute of Burkina Faso

29	IMF	International Monetary Fund	
30	INERA	Institute of Agricultural Environment	
31	ITRF	International Terrestrial Reference Frame	
32	INSD	Institute of Demography	
33	ISO	International Organization for Standardization	
34	JICA	Japan International Cooperation Agency	
35	JBcarte	Japan, Burkina Faso Mapping Project	
36	KML	Keyhole Markup Language	A file format developed to display geographic data on Google-based browsers: It is supported not only by Google-based browsers but also by various GIS applications.
37	KMZ	Keyhole Markup Zip	A zipped KML text file format
38	LGO	Leica Geo Office	Software to analyze GPS observation results
39	LPS	Leica Photogrammetric Suits	Software for photogrammetric data extraction from images
40	MCA	Millennium Challenge Account	
41	MMS	Mobile Mapping System	
42	NMO	National Mapping Organization	
43	NSDI	National Spatial Data Infrastructure	
44	OJT	On the Job Training	Acquisition of technologies and knowledge from practical working experience
45	PDF	Portable Document Format	A file format for electronic documents developed by Adobe Systems
46	PDOP	Position Dilution of Precision	Indicator for appropriateness of geometry of satellite positions
47	PRISM	Panchromatic Remote-sensing Instrument for Stereo Mapping	Optical sensor using the visible wavelength bands of ALOS capable of observing the ground surface with 2.5 m spatial resolution
48	RPC	Rational Polynomial Coefficients	Coefficients of rational polynomials describing relationship between satellite images and topography
49	SHP	Shape File	A data file format supported by GIS
50	SONABEL	National Electricity Company of Burkina Faso	Société Nationale Burkinabé d'Electricité
51	UEMOA	Union économique et monétaire ouest-africaine	West African Economic and Monetary Union
52	UPS	Uninterruptable Power Supply	
53	UTM	Universal Transverse Mercator	
54	WFP	World Food Program	
55	WGS84	World Geodetic System 1984	One of the reference ellipsoids constituting the World Geodetic System

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Chapter 1 Outline of Study

1.1 Background of Study

Burkina Faso, an inland country in Western Africa, became independent from France in 1960 and celebrated its 50th anniversary of independence in 2010. Despite its steady economic growth with an average GDP growth rate of 5.5% between 1995 and 2008, the GDP per capita is still as low as 536 dollars (2010) with poverty being more serious in rural areas. Under such circumstances, Burkina Faso established a new national development plan, SCADD: Strategy for Accelerated Growth and Sustainable Development (Stratégie de Croissance Accélérée de Développement Durable): 2011 – 2015, and is pursuing agricultural development, education, and resources development according to the basic policy of "poverty reduction through economic growth."

In this operation, the National Base Map serves as basic information for national development closely related to important issues such as development planning and border demarcation, and is therefore handled as important data for planning of mining development, environment, agriculture, stockbreeding, etc. In particular, the National Base Map is highly important for the northern area aiming at systematic and strategic planning from the viewpoint of development of mineral resources such as manganese and gold, promotion of stockbreeding, and preservation of environment. Therefore, development of topographic maps in Burkina Faso is considered to be a priority area.

The development of the 1/50,000 National Base Map of Burkina Faso has been promoted by the Geographic Institute of Burkina Faso (Institut Géographique du Burkina: IGB) on its own with national budget and other funds using the outcome of the technology transfer conducted in the development study, "Study for National Topographic Mapping of Southwestern Area in Burkina Faso," implemented by JICA with IGB as the counterpart organization from 1998 to 2000. However, only 36% of all the 1/50,000 topographic maps have been created up to the present, and their preparation is being delayed due to the financial circumstances of Burkina Faso. In the northern area, the delay of map development is having a negative impact on the development of mineral resources, water resources, etc.

IGB has acquired basic technology for digital topographic mapping and is creating topographic maps. However, it still has technical problems in some processes such as plotting and compilation. Thus, there are also problems in the substantial production system because, for one, the creation and updating of topographic maps incurs cost and time due to use of aerial photographs in topographic mapping. This is part of the cause of the delay in development of the National Base Map. Recently, however, the introduction of technology for medium-scale topographic mapping using satellite images has enabled quick and inexpensive creation of digital topographic maps of a required area. Therefore, it has been confirmed that the construction of a system for mass production through the acquisition of this technology is an important support for Burkina Faso for the sake of the development of the National Base Map and consequently the promotion of national land development.

Against the above background, the Study Team for detailed planning was dispatched in October 2011. The Study Team discussed with the Government of Burkina Faso on digital topographic mapping of

the northern area of the country and the technology transfer, and signed a Record of Discussion (R/D) for this project.

1.2 Geographic Institute of Burkina Faso (Institut Géographique du Burkina)

The Geographic Institute of Burkina Faso (Institut Géographique du Burkina, hereinafter referred to as IGB) was established in 1976 as a department of the Ministry of Public Works. In accordance with the government ordinance issued in 1987, it became an administrative public institution which was to be operated with revenue from its services.

The organizational structure of IGB is as follows:

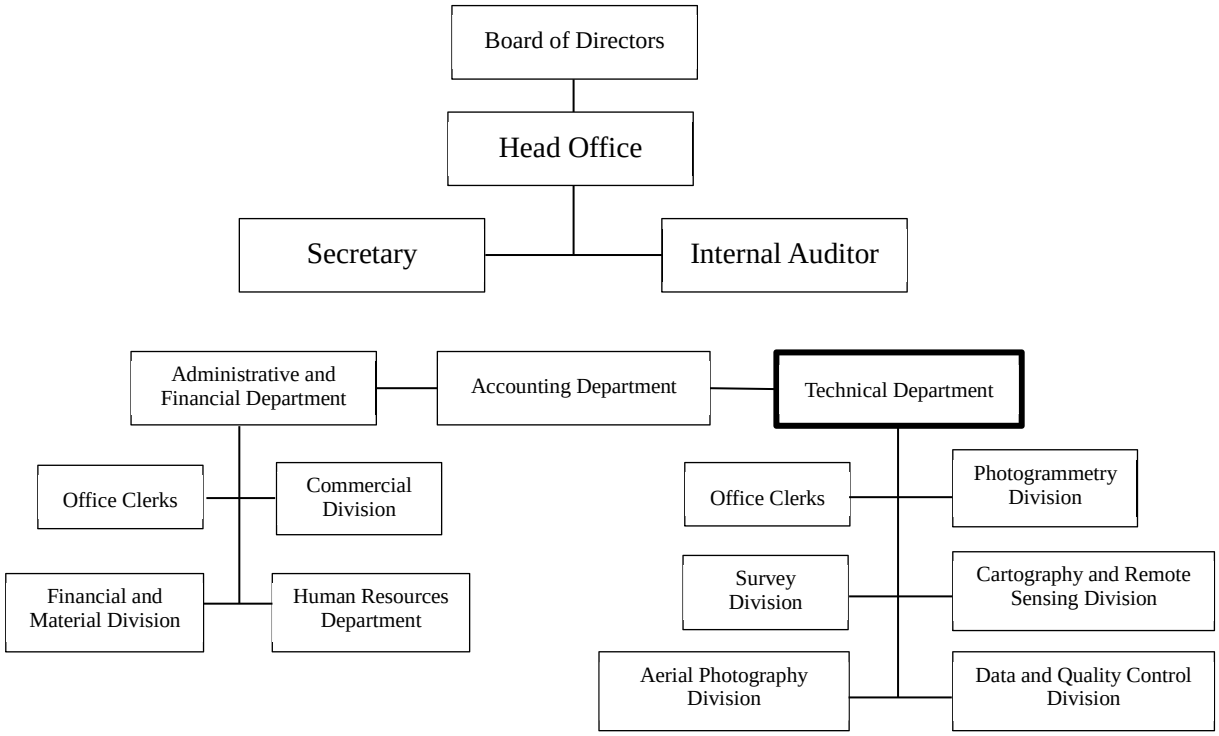


Figure 1-1 Organizational structure of IGB

At present, IGB has 67 staff members and 38 of them (including Mr. Tapsoba, the Director General, Mr. Belem, the Director of the Technical Department, Mr. Compaore, JICA Project Manager and Mr. Sanou, EU Project Manager) are technicians.

The staff list obtained by the Study Team describes the number of the staff members and responsibilities assigned to each division in the Technical Department as follows:

- Photogrammetry Division 5: aerial triangulation, plotting and field identification
- Survey Division 7: ground control point survey, leveling and field identification
- Cartography and Remote Sensing Division 14: compilation, GIS and remote sensing
- Aerial Photography Division 4: aerial photography and photo processing
- Data and Quality Control Division 4: data and quality control of survey data

1.3 Purposes of Study

This Study had the following two purposes:

(1) Creating 1/50,000 digital topographic maps of the northern area of Burkina Faso (about 23,000 km^2) and the area surrounding Ouagadougou (about 3,000 km^2) using satellite images

(2) Conducting OJT-based technology transfer to IGB in the process of creating topographic maps to contribute to enhancing their topographic mapping capability

1.4 Study Area

This study project covers a total area of 26,000 km^2, in which study is conducted on the northern area of Burkina Faso (about 23,000 km^2) and OJT-based technology transfer is conducted on the capital city Ouagadougou district (about 3,000 km^2). To enable learning of topographic mapping technology to be applied to various land-uses, the study was scheduled to be conducted as OJT on the two map sheets in the area surrounding Ouagadougou, characterized by urban landscapes, and the two map sheets in the northern area, characterized by natural landscapes, out of the 36 map sheets in total. Figure 1-2 shows the study area.

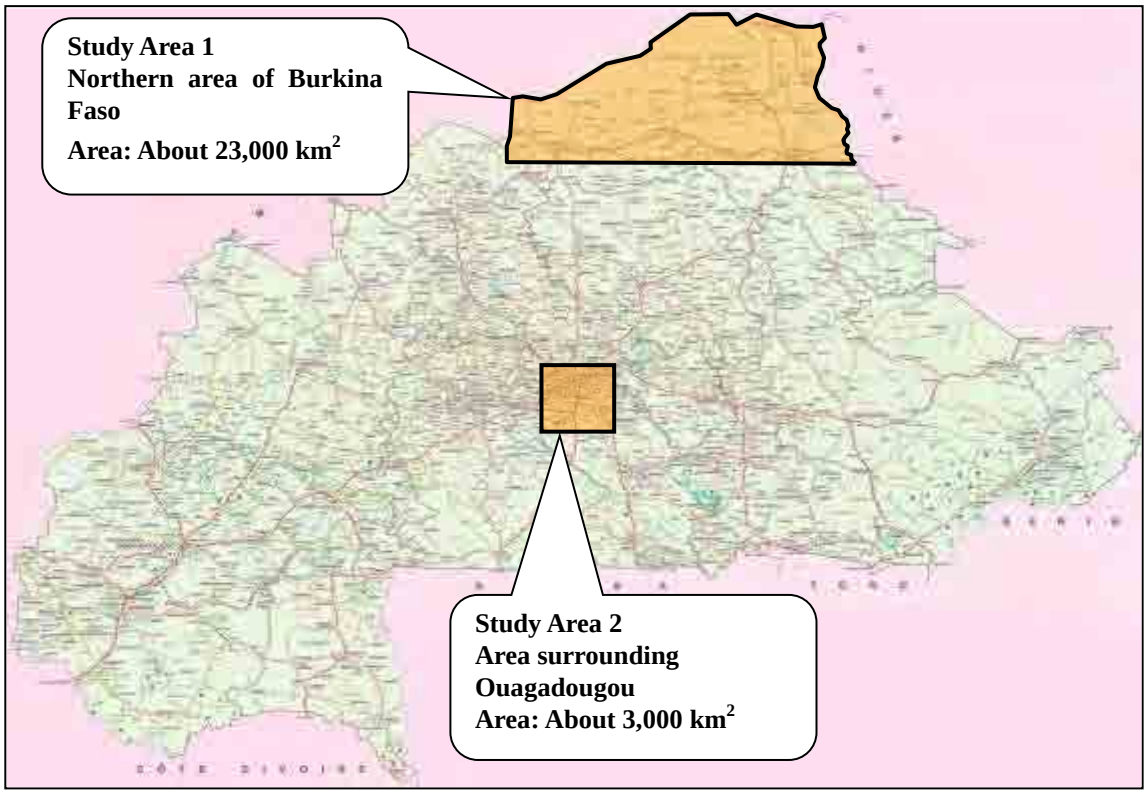


Figure 1-2 Study area positions and area covered in supplied satellite images

1.5 Basic Project Policies

1.5.1 Basic Technical Policies

Based on the background and purposes of this study, particular technical considerations are required for the following items.

Basic technical policy 1: Technology transfer focused on quality management

The counterpart organization IGB created medium-scale maps on its own based on the technology transfer conducted by JICA in 1998 to 2000. Additionally, it has abundant experience in control point survey covering also ground control points and field identification such as updating of 1/200,000 topographic maps by MCA and EU, already having a certain technical capability level. However, our verification found that IGB has acquired basic-level plotting and compilation technology but does not yet have sufficient skills, which needs improvement.

Basic technical policy 2: Survey criteria

In this study, the specifications with the recipient country were discussed after the project start and the survey work was decided to implement based on the following survey criteria:

- Map projection.....BFTM (Burkina Faso Transverse Mercator)
- Geographic coordinate system.....ITRF2008/Adidan
- Reference ellipsoid.....GRS80
- Reference elevation.....Dakar port mean sea level/existing benchmarks
- Annotation.....The following annotation was provided in data files and on marginal information:

This digital map was prepared jointly by Japan International Cooperation Agency (JICA) under the Japanese Government Technical Cooperation Program and the Government of Burkina Faso.

Basic technology policy 3: Compliance with Overseas Mapping (National Base Map) Standard Specifications

The work related to creation of digital topographic maps in this study complied with the Overseas Mapping (National Base Map) Standard Specifications.

The “Burkina Faso Format Rules” were created in a period when digital topographic mapping was not yet in the mainstream. Therefore, after consultation with IGB, it was decided to edit the operation manual to be compliant with creation of digital topographic maps, which is in the mainstream at present, and new operation manuals and format rules were proposed to ensure efficient progress of the project.

Basic technical policy 4: Collaboration with EU project

At present, EU is implementing a project for creating 1/200,000 topographic maps in collaboration with IGB as the implementing agency. Since the field GNSS verification was already completed at the time of our study, aerial triangulation was conducted from January 2013 using German satellite image "Rapid Eye" data followed by the start of digital plotting. 13 out of 27 sheets of 1/200,000 topographic maps covering the whole national land area were completed on January 30, 2014, which were delivered to the Government of Burkina Faso. Our study was conducted in close relationship with the EU project by sharing information such as acquired and created data.

Basic technical policy 5: System for sustainable human resources development

As with agencies of other developing countries, IGB is faced with aging of its technicians. Therefore, technology transfer should be focused on preparation of work manuals (work procedures in various processes), operation manuals, etc., to ensure that technicians can continue the work under any circumstances, rather than to train young technicians.

Basic technical policy 6: Public relations and promotion of utilization

The utilization of outputs was promoted by holding workshops and seminars, etc. Furthermore, the counterpart was encouraged to plan and implement holding workshops and seminars on its own to promote sustainability.

Basic technical policy 7: Promotion of wide-area collaboration for topographic mapping technology

Since Burkina Faso is a leading country in medium-scale topographic mapping technology in the West Africa area, a technical seminar was held to share information about technical progress with participants invited from surrounding countries, in addition to a technology transfer seminar. This seminar was held in collaboration with the West African Economic and Monetary Union (Union Economique et Monétaire Ouest Africaine: UEMOA) to introduce the technologies used in this study to contribute to providing support for topographic map development in the West Africa region.

1.5.2 Basic Management Policies

Based on the background and purposes of this study, particular management considerations were required for the following items.

Basic management policy 1: General

As a basic policy for implementing this study, the Terms of Reference (TOR) provided by JICA was observed. Furthermore, this study was to be implemented on the premise that all the members of the Study Team should share sufficient understanding and recognition of the technical cooperation by the Government of Japan and, to ensure this premise, had communications with each other on a planned basis.

Basic management policy 2: Safety measures

The study was implemented based on safety measures specified by JICA. In principle, none of the Study Team members entered the northern area of Burkina Faso.

Basic management policy 3: System for implementing study

In view of the security circumstances, the ground control point survey that needs field identification in the project area and the field identification and verification were conducted in the northern area by IGB itself using the technology transferred in advance in the Ouagadougou district because IGB already has a certain level of technology as described earlier.

Basic management policy 4: Selection of engineers

The study was implemented with certainty by technicians who have as much overseas experience as possible and excellent skills for creating geographic data as well as technicians who are familiar with and have skills and experience in utilization of digital data and maps and effective utilization and popularization of GIS.

Basic management policy 5: Holding of technology transfer seminar

At the beginning of this project, a project kick-off seminar was held to announce the overview of the project and promote the utilization of data to be created. At the end of this project, a technology transfer seminar was held to announce the outcomes of the technology transfer and promote popularization and utilization of the GIS database created.

Basic management policy 6: Safety management

The study area is where yellow fever is common. Although the overseas travel information says that a vaccination is “recommended,” the Study Team members got a vaccination before visiting this country

according to the instruction provided by the local embassy. They had to carry specialized medicine all the time and take it immediately when they feel sick to prevent getting seriously ill.

1.6 Composition of Study Team

The composition of the Study Team and their main work are as shown in the following Table 1-1.

Table 1-1 Composition of the Study Team and their main work

Name	Responsibility	No.	Work content
Mr. Takashi HARADA	Team leader	(1)	Collection, sorting and analysis of relevant documents and information
		(2)	Preparation of Inception Report
		(3)	Explanation and discussion of Inception Report
		(4)	Discussions on specifications
		(5)	Collection and sorting existing materials
		(6)	Obtaining satellite images
		(7)	Aerial photography
		(8)	Ground control point survey
		(9)	Aerial triangulation
		(10)	Field identification and field verification
		(11)	Digital plotting and compilation
		(12)	Preparation of Interim Report
		(13)	Explanation and discussion of Interim Report
		(14)	Map symbolization of topographic maps
		(15)	Digital data structurization
		(16)	Creation of data files
		(17)	Preparation of output maps
		(18)	Promotion of utilization
		(19)	Holding technical seminar for wide-area collaboration
		(20)	Preparation and discussion of Draft Final Report
		(21)	Preparation of Final Report
		(22)	Operation associated with technology transfer
			Creation of orthophotos
Mr. Takao IKEDA	Discussions on specifications	(1)	Collection, sorting and analysis of relevant documents and information
		(2)	Preparation of Inception Report
		(3)	Explanation and discussion of Inception Report
			Creation of map symbol specifications (draft)
			Creation of marginal information (draft)
		(4)	Discussions on specifications
Mr. Masaji KOYAMA	Ground control point survey 1	(2)	Preparation of Inception Report
		(5)	Collection and sorting existing materials
		(8)	Ground control point survey
		(12)	Preparation of Interim Report
		(20)	Preparation of Draft Final Report
		(22)	Technology transfer (① Ground control point survey, ⑨

			Quality management)
Mr. Masaaki ECHIZEN	Ground control point survey 2	(8)	Ground control point survey
		(12)	Preparation of Interim Report
		(20)	Preparation of Draft Final Report
		(22)	Technology transfer (① Ground control point survey, ⑨ Quality management)
Mr. Takao IKEDA	Aerial triangulation	(2)	Preparation of Inception Report
		(9)	Aerial triangulation
		(11)	Preparation of Interim Report
		(19)	Preparation of Draft Final Report
		(22)	Technology transfer (b. Aerial triangulation)
Mr. Yoshihide OMURA	Field identification, field verification	(2)	Preparation of Inception Report
		(10)	Field identification (plotting / ground photographs to assist compilation, operation of handled GPS receiver) / field verification
		(12)	Preparation of Interim Report
		(20)	Preparation of Draft Final Report
		(22)	Technology transfer (c. Field identification/field verification)
Mr. Takao IKEDA	Digital plotting	(2)	Preparation of Inception Report
		(11)	Digital plotting
		(12)	Preparation of Interim Report
		(20)	Preparation of Draft Final Report
		(22)	Technology transfer (d. Digital plotting, partial correction)
Mr. Jun HOSHINO	Digital compilation	(2)	Preparation of Inception Report
		(11)	Digital compilation
		(12)	Preparation of Interim Report
		(16)	Creation of data files
		(20)	Preparation of Draft Final Report
		(22)	Technology transfer (d. Digital compilation, ⑨ Quality management, ⑩ Partial correction)
Mr. Takeshi MIYATA	Map symbolization	(2)	Preparation of Inception Report
		(14)	Map symbolization
		(16)	Creation of data files
		(20)	Preparation of Draft Final Report
		(22)	Technology transfer (f. Map symbolization)
Ms. Junko YAMASHITA	Data structurization	(2)	Preparation of Inception Report
		(15)	Data structurization
		(16)	Creation of data files
		(20)	Preparation of Draft Final Report
		(22)	Technology transfer (e. Data (GIS) structurization)
Mr. Mitsuo IWASE	Utilization plan	(1)	Collection and analysis of existing documents and information

		(2)	Preparation of Inception Report
		(18)	Utilization plan/promotion
		(19)	Holding technical seminar for wide-area collaboration
		(20)	Preparation, explanation and discussion of Draft Final Report
		(21)	Preparation of Final Report
		(22)	Technology transfer (g. Utilization / construction of system of usage, seminar)
Mr. Naoki GOTO	Construction of website		Construction of website
		(20)	Preparation, explanation and discussion of Draft Final Report
		(22)	Technology transfer (Construction of website, Seminar)
Mr. Yuji OUCHI	Operation coordination / Digital plotting assistance	(1)	Collection, sorting and analysis of relevant documents and information
Ms. Naomi TAMURA		(3)	Explanation and discussion of Inception Report
Mr. Takashi TOMURA		(5)	Collection and sorting existing materials
		(6)	Obtaining satellite images
		(12)	Explanation and discussion of Interim Report
		(19)	Holding technical seminar for wide-area collaboration
		(20)	Explanation and discussion of Draft Final Report
		(22)	Technology transfer (Seminar)

1.7 Personnel Plan

The final personnel plan for implementation of the study is as shown in the following table.

Table 1-2 Personnel plan

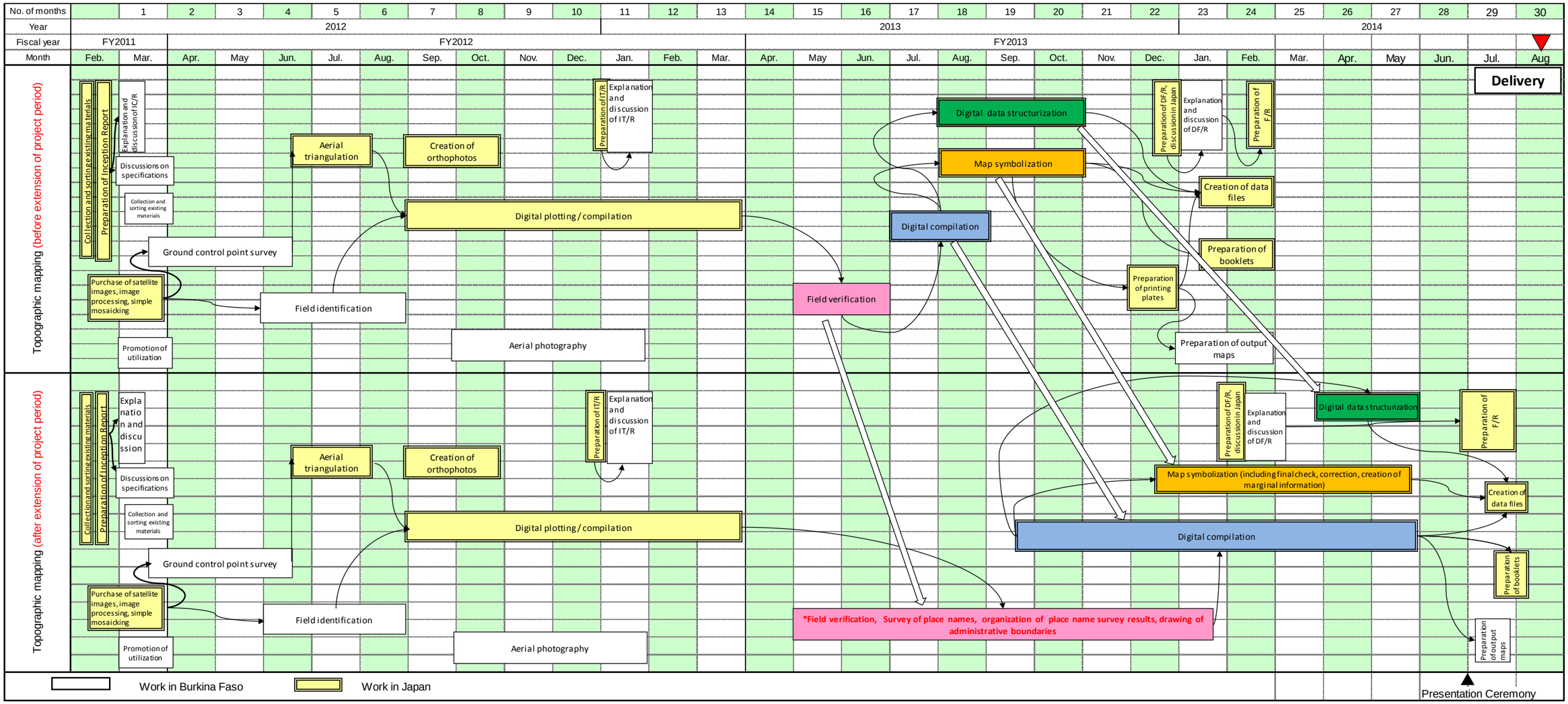
Responsibility	Name	Affiliation	Grade	FY 2011 Feb.	FY 2011 Mar.	FY2012 Apr.	FY2012 May	FY2012 Jun.	FY2012 Jul.	FY2012 Aug.	FY2012 Sep.	FY2012 Oct.	FY2012 Nov.	FY2012 Dec.	FY2012 Jan.	FY2012 Feb.	FY2012 Mar.	FY2013 Apr.	FY2013 May	FY2013 Jun.	FY2013 Jul.	FY2013 Aug.	FY2013 Sep.	FY2013 Oct.	FY2013 Nov.	FY2013 Dec.	FY2013 Jan.	FY2013 Feb.	FY2013 Mar.	FY2014 Apr.	FY2014 May	FY2014 Jun.	FY2014 Jul.	FY2014 Aug.
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Work in Burkina Faso																																	
Operation management group Team Leader	Mr. Takashi HARADA	Aero Asahi Corp.	2																														Delivery
Sub Team Leader	Mr. Takao IKEDA	Aero Asahi Corp.	3																														
Discussions on specifications	Mr. Takao IKEDA	Aero Asahi Corp.	4																														
Ground control point survey 1	Mr. Masaji KOYAMA	Aero Asahi Corp.	3																														
Ground control point survey 2	Mr. Masaaki ECHIZEN	Hokkaido Aero Asahi Corp.	4																														
Field identification/verification	Mr. Yoshihide OMURA	Kokusai Kogyo Co., Ltd.	3																														
Aerial triangulation	Mr. Takao IKEDA	Aero Asahi Corp.	4																														
Digital plotting	Mr. Takao IKEDA	Aero Asahi Corp.	4										29																				
Digital compilation / Digital compilation after field verification	Mr. Jun HOSHINO	Aero Asahi Corp.	5																														
Map symbolization	Mr. Takeshi MIYATA	Kokusai Kogyo Co., Ltd.	5																														
Data structurization	Ms. Junko YAMASHITA	Aero Asahi Corp.	4																														
Utilization plan/promotion	Mr. Mitsuo IWASE	Infrastructure Development Institute-Japan	3																														
Construction of website	Mr. Naoki GOTO	Aero Asahi Corp.	4																														
Operation coordination/ Digital plotting	Mr. Yuji OUCHI Ms. Naomi TAMURA Mr. Takashi TOMURA	Aero Asahi Corp.	4																														
Interpreter	Mr. Noboru OKADA Ms. Akemi NISHIYAMA	Freelance	4																														
Work in Japan																																	
Operation management group	Mr. Takashi HARADA	Aero Asahi Corp.	2		▲ Inception Report		▲ May 25 Opening Seminar						▲ Dec. 18-19 Technical Seminar for Wide-Area Collaboration					▲ Explanation and discussion of Interim Report									▲ Feb. 13-14 Technical Seminar for Wide-Area Collaboration				▲ Explanation and discussion of Draft Final Report		▲ Ceremony of Presentation of Topographic Maps

Legend: Work in Burkina Faso / Work in Japan

Chapter 2 Implementation Status of Study Operations

The following table shows the workflow of the operations implemented.

Table 2-1 Operation workflow



2.1 (1) Collection, Sorting and Analysis of Relevant Documents and Information (Work in Japan)

Before the start of field identification, the following operations were implemented in Japan.

- Sorting and analysis of materials collected by the Preliminary Study Team and our company on their own
- Creation of format rules (draft) for discussion on specifications
- Summary of basic policies, work methods, procedures, etc.

Furthermore, additional information that can be acquired in Japan was collected, sorted, and analyzed.

2.2 (4) Discussions on Specifications (Work in Burkina Faso)

At the start of the project, the Inception Report was discussed regarding the specifications of topographic maps to be created, survey criteria, field verification methods, etc. and the result of the discussion was confirmed in the Minutes of Meeting (Annex-1). The basic specifications (such as format rules, map symbols, and annotations) required to create 1/50,000 topographic maps in this study must comply with the specifications conventionally owned by IGB in principle, but the details were determined through discussion with IGB based on the "Overseas Mapping (National Base Map) Standard Specifications" (Annex-2).

2.3 (5) Collection and Sorting Existing Materials (Work in Burkina Faso)

The following existing data that can be utilized in this study, such as the existing topographic maps and survey outcomes, was collected and sorted in Burkina Faso.

- African Mapping Standard (owned by IGB)
- "Guidelines for the Creation of Topographic Maps Using ALOS Optical Images to Support GIS Infrastructure Development Activities in the Asia-Pacific Region" (created by Geospatial Information Authority of Japan in 2009), etc.

The collected topographic maps are shown in the table below.

Table 2-2 List of existing topographic maps

Topographic map scale	Mapping rate	Year of mapping	Remarks
1/50,000 topographic maps	36%	1984 –	137 sheets including 32 created by JICA in 2001
1/200,000 topographic maps	100%	1960 –	34 sheets created by France and being partially modified by EU
1/500,000 topographic maps	100%	1966	9 sheets
1/1,000,000 topographic maps	100%	2010	1 sheet

2.4 (6) Purchase of Satellite Images (Work in Japan)

The satellite images acquired for the study area (about 26,000 km^2) were ALOS/PRISM images with a resolution of 2.5 meters, which enable stereoscopic view and are constantly acquired.

2.5 (7) Aerial Photography (Work in Burkina Faso)

In the urban planning and development area of about 1000 km^2 in the Ouaga 2000 district in Ouagadougou and its surrounding area, aerial photography was conducted using the following specifications:

- Date of photography: September 13, 2012
- Photography aircraft: King Air B200
- Photo scale: About 1/20,000
- Camera: RC30
- Lens: WILD 15/4 UAD-S
- Focal length: 153.51 mm
- Flight altitude: About 3000 m
- Film: AGFA AVIPHOT PAN, Panchromatic film 24 cm x 76 m Gevar Polyester
- Number of courses: 9
- Area photographed About 1,000 km^2
- Number of photographs: 238

For the taken photos, films were developed promptly in the IGB darkroom, contact prints were made, and the quality control operation was conducted. The results were as follows:

- Overlap: 55% or more
- Sidelap: 30%±5%

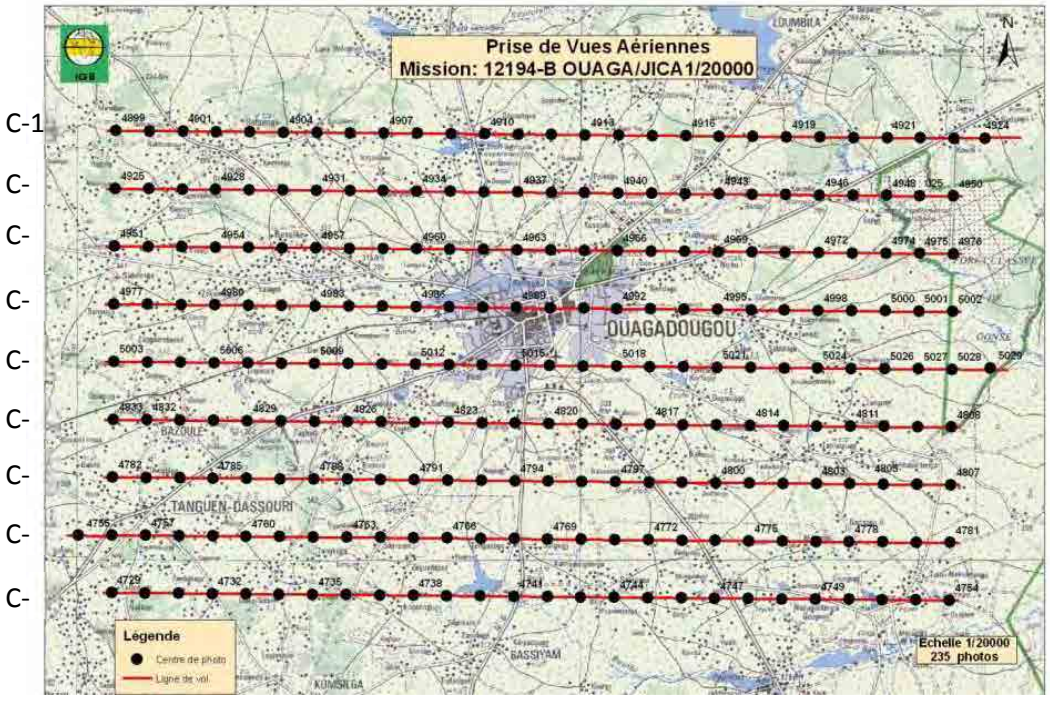


Figure 2-1 Index map for aerial photography

2.6 (8) Ground Control Point Survey (Work in Burkina Faso)

A GNSS-based ground control point survey was conducted as described below.

[Point Selection Plan]

Before planning and implementing the ground control point survey, the Study Team selected the approximate positions of ground control points by making effective use of Google Earth images, 1/50,000 and 1/200,000 topographic maps, and description of existing control points.

[Observation Plan]

According to the Overseas Mapping Standard Specifications, an observation plan was established using three GNSS-2 frequency receivers, one level, and four vehicles. Known points were selected in view of distances from new points, access conditions, etc.

The plan specified that the elevation values of ground control points to be checked by direct leveling from the benchmarks.

[Check of Equipment before Use]

A functional check of equipment to be used for observation was conducted before observation.

[Technical Consultation with IGB (Survey Criteria, Existing Control Points, Structure of Observation Groups)]

The Study Team discussed with IGB and confirmed that the survey should be conducted using the following survey criteria:

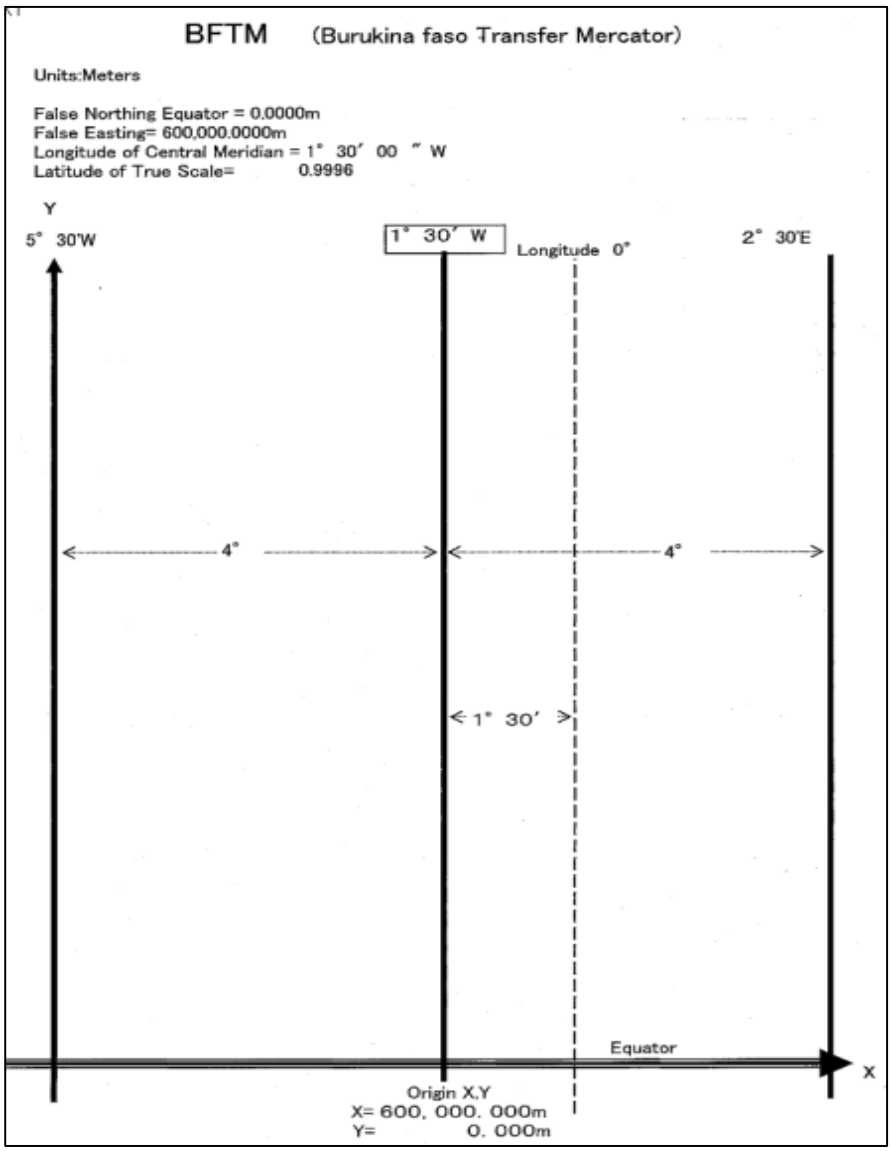


Figure 2-2 BFTM orthogonal coordinate system

Table 2-3 Survey criteria

Geographic coordinate system	ITRF2008
Map projection	BFTM (Extended 30 Zone=BFTM)
Reference ellipsoid	GRS 80
Elevation	Dakar port mean sea level/existing benchmarks

[GNSS Observation]

Simultaneous GNSS observation was conducted at two existing control points as known points and one new ground control point. The standard observation duration was set as one hour or longer, and the observation timing was coordinated and determined by the four observation groups which contacted each other.

Resurveys due to mismatches of ground control points and selected positions were conducted by using the primary ground control point established in this project to obtain the position of the secondary ground control point via open routes by GNSS observation (30 minutes).

Photo 2-1 GCP-01

Photo 2-2 GPS control point 2BG399

[Baseline Analysis]

After observation was completed, the Study Team downloaded the GNSS observation data on known points and ground control points to the analysis PC and converted to RINEX. Each observation session was checked by applying mutatis mutandis the limit values specified in the Article 42-D, "GNSS Observation A (3)" of "Working Rules for Public Survey Work Regulations" of Japan. All the check results were within the limit values, and good results were obtained.

[Network Adjustment]

After the check of location accuracy in baseline analysis, network adjustment was conducted for each session by fixing the longitudes and latitudes and ellipsoid heights in known point results. The 3D network adjustment was conducted using the embedded software in LGO. The geoid model used to obtain elevations from the ellipsoid heights was Earth Gravitation Model 1996 (EGM96).

[Pricking of Ground Control Points]

The pricking of ground control points was conducted by outputting the ALOS image data in an enlarged form and checking it against the planimetric features in the field. The pricked points in images, neighborhood sketches, and ground photographs were summarized in the pricking point description sheet of ground control points.

[Verification of Ground Control Point Elevations Using Existing Benchmarks]

The verification results for the elevation values obtained from GNSS/EGM96 were within a difference of 60 cm. It has been confirmed, therefore, that the elevation values obtained from EGM96 can be used in this study.

[Consideration]

Before the GNSS observation was conducted in the field, training was given regarding observation planning, functional check and organizing of equipment, GNSS installation, selection of ground control point positions, creation of description of pricking point, shooting using digital cameras, etc. To check whether the training contents are conducted properly in the field, the Study Team members visited the GNSS observation sites as required.

For the sake of security, the Study Team members checked the operation results and conducted quality control and process control in the Dori-Djibo district without entering the district. During the operation, sandstorms from the Sahara (Harmattan) were encountered several times, but all the operations were safely completed thanks to appropriate decisions made and actions taken by IGB technicians.

2.7 (9) Aerial Triangulation (Work in Japan)

The ALOS/PRISM images are provided from a data provider as a so-called exterior orientation model called an RPC model. The RPC models are files that describe rational polynomial coefficients by which satellite images and ground space are connected, being similar to exterior orientation parameters in aerial photographs. The plotter can convert the RPC models associated with satellite images (ALOS/PRISM) into stereo models, allowing measurement of the 3D coordinates of planimetric features in the images. The RPC models were readjusted through adjustment calculation using the image coordinates of tie-points and ground control points, RPC models, and ground control point results (3D coordinates). The result is described below.

[Implementation Period]

- From June to August 2012

[Scope of Implementation]

The scope of implementation is shown below. In the plotting range of about 26,000 km^2, 183 ALOS/PRISM images (61 scenes x triplet) were used. Since the study area is divided into two districts, the work was conducted separately on the two blocks.

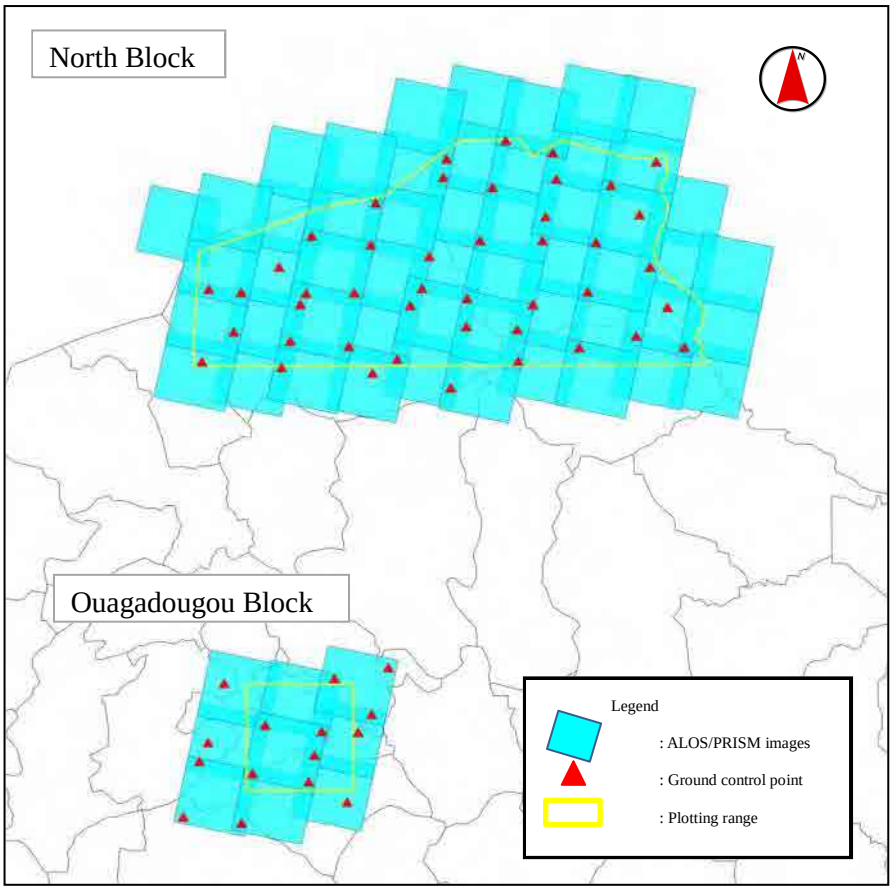


Figure 2-3 Blocks for aerial triangulation

[Data used]

The used data is as follows:

- Satellite images: ALOS/PRISM, Level 1B1, CEOS format
- Orientation model: RPC model
- Ground control points: 59 points in total
- Reference coordinate system
  - Map projection: BFTM (Burkina Faso Transverse Mercator)
  - Reference ellipsoid: GRS80
  - Geodetic coordinate system: ITRF2008

[Software used]

The following software was used:

- LPS2011, Intergraph product

[Implementation Flow]

Aerial triangulation was implemented using the following workflow:

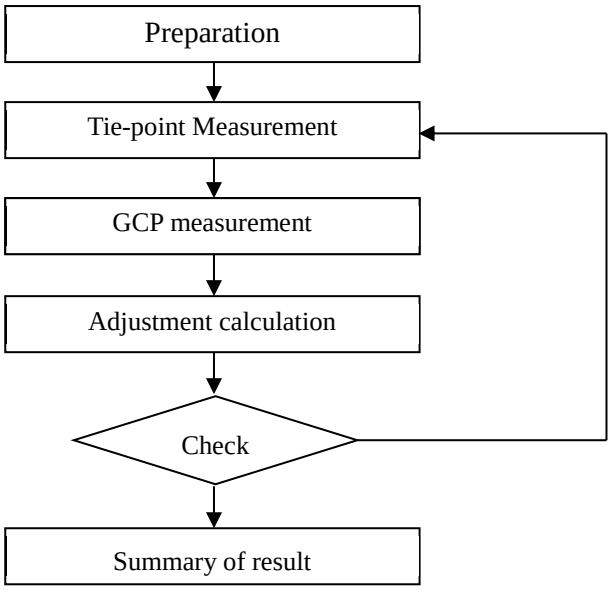


Figure 2-4 Aerial triangulation workflow

[Description of Implementation]

a) Preparation (Change of Scene IDs)

Before the implementation of aerial triangulation, the scene IDs were changed to numbers that can be easily managed in this project. Scene IDs after change are shown in Figure 2-5.

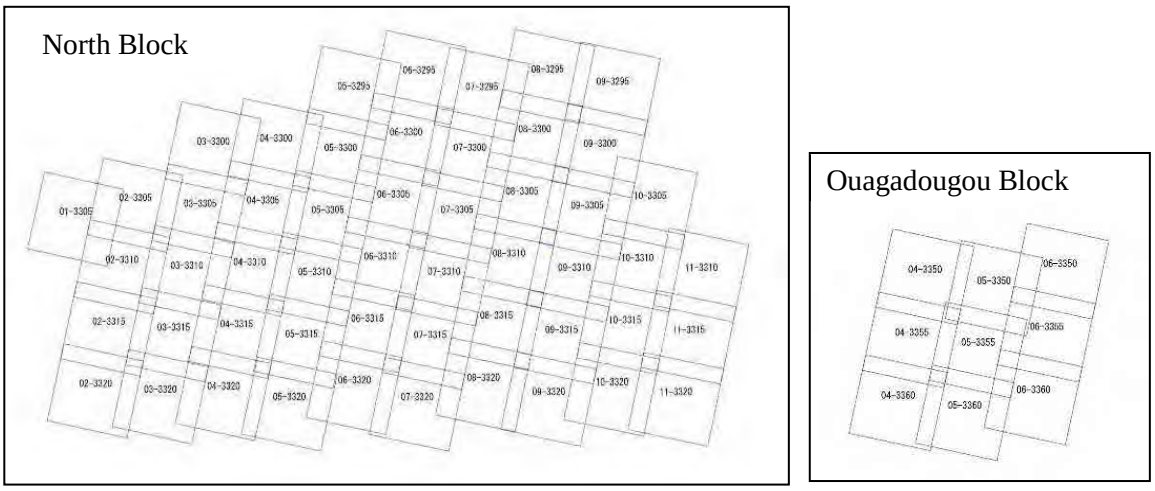


Figure 2-5 Scene IDs after change

b) Tie-point Measurement

In this process, the Study Team executed automatic processing in the beginning and later checked the points with large residual errors and needed points, made corrections or conducted additional measurement as required, and acquired the image coordinates of tie-points.

c) Ground Control Point Measurement

Using the description sheet acquired in ground control point measurement, the image coordinates of the ground control points were measured. Since the ground control points were selected taking into consideration overlap of images, 12 images were measured per point at the maximum.

d) Adjustment Calculation and Results

Adjustment calculation was conducted using the image coordinates of tie-points and ground control points, ground control point results (3D coordinates), and RPC models. The limit values used to determine the conformance of results were the following values specified in the "Guideline for Creating 1/50,000 Topographic Maps Using ALOS Optical Images" created by the Geospatial Information Authority.

(Limit values)

Control point residual error

: Horizontal position : 5.0 m standard deviation, 10.0 m maximum value

: Height : 3.3 m standard deviation, 10.0 m maximum value

Intersection residual error : 1.0 pixel standard deviation, 2.0 pixels maximum value

The calculated intersection residual errors and control point residual errors are shown in the table below.

Table 2-4 Aerial triangulation results

Block	Intersection residual error (Unit: pixel)		Control point residual error (Unit: m)				Remarks
			Horizontal location		Height		
	Standard deviation	Maximum value	Standard deviation	Maximum value	Standard deviation	Maximum value	
North	0.18	1.73	2.476	5.909	1.882	4.414	Removed forward view images in odd-number paths
Ouagadougou	0.21	1.31	2.402	5.518	0.383	0.682	Same as above

e) Summary of Results

The RPC models after adjustment were stored in the format of LPS, the supplied software, so that they can be used by IGB in the future. At the same time, they were also stored in text format scene by scene in consideration of versatility.

2.8 (10) Field Identification and Field Verification (Work in Burkina Faso)

(Field identification : 90 days from May 27 to August 21, 2012)
(Field verification : 74 days from May 8 to July 20, 2013)

The work overview for field identification (photo interpretation) and field verification is shown below.

◆ Work Area and Volume
Area surrounding Ouagadougou: 3,000 km^2 (4 sheets)
Northern area of Burkina Faso: 23,000 km^2 (36 sheets)

◆ Work Period
Field Identification
June 11 to August 12, 2012
Field Verification
June 6 to December 15, 2013

◆ Work Team Members
The following five members participated from IGB.

Ms. Sougue Mr. Koudougou Mr. Nikiema Mr. Konate Ms. Coulibaly

Photo 2-3 IGB technicians participated in the technology transfer on field identification and field verification

[Photo interpretation]

Since Burkina Faso has a wide variety of unique vegetation types not found in Japan, plotting work in Japan would make it difficult to distinguish them. If IGB conducts plotting, on the other hand, it is important to unify the vegetation interpretation results. For the scope of interpretation, therefore, the counterpart technicians discussed vegetation interpretation to unify the interpretation criteria before starting the work. All the technicians had experience in photo interpretation (plotting and compilation) although the level of experience varies among them.

Photo 2-4 Discussion about interpretation method

Photo 2-5 Image interpretation in progress

[Field Identification]

The field identification photos have as small a scale as 1/50,000, making it difficult to identify houses in a concentrated area. Therefore, the adopted method was to shoot landmark objects with GPS-enabled digital cameras to obtain the planimetric feature types and location information simultaneously. The field identification was conducted in four groups, each consisting of one person. One vehicle was assigned to each of the groups so that the field identification could be conducted by each of them independently.

Photo 2-6 C/P member explaining to another member

Photo 2-7 Field identification by interview

[Field Verification]

Questionable points identified in the results of the field identification and in the digital compilation and annotations of place names were verified in the field verification. ‘Symbols,’ ‘vegetation,’ ‘areas,’ ‘forms,’ ‘positions, ‘annotations’ and ‘features’ were the survey items in the field verification.

Photo 2-8 Training on operation of the tablet (in an office)

Photo 2-9 Training on operation of the tablet (at IGB premises)

The survey was conducted in accordance with the description on the verification sheets. The subjects of the verification were photographed as in the field identification.

[Survey of place names]

A decree issued in December 2011 makes it mandatory to study not only new place names but also histories of old place names in toponymic surveys conducted under the instruction of the National Commission of Toponymy established for toponymic surveys. Because of this stipulation of the decree, an extravagant amount of time had to be spent on the survey of place names. In the end, it took more than three times as long as it was scheduled in the original plan to complete the field verification.

[Topographic Survey]

In the topographic survey, the Study Team visited local administration offices, interviewed officials in charge of geographic information and obtained latest reference materials on villages. Then, the team visited villages and acquired information on the conditions in and around the villages from their leaders.

Photo 2-10 Interview with an official of a local administration

Photo 2-11 Interview with a village leader

2.9 (11) Digital Plotting/Compilation (Work in Japan)

The outputs mentioned below were created in the digital plotting/compilation conducted in Japan:

- Digital plotting/compilation sheets :40 sheets
- Edit sheets for field verification :40 sheets

2.9.1 Digital Plotting

The digital plotting was carried out in accordance with the standard specifications mentioned below. The data of the orientation of satellite images acquired in the aerial triangulation were used in the digital plotting. In order to facilitate interpretation, all the images used in the plotting were pan-sharpened and stereoscopy of those images was carried out in the plotting.

[Specifications for the plotting]

- Satellite images : ALOS (forward, backward and nadir views)
- Ground resolution: : 2.5 m
- Plotting scale : 1/50,000
- Plotted area : approx. 26,000 km^2
- Number of plotted sheets : 44 (excluding the extended areas)
- Contour intervals : 10 m between the intermediate contours
  50 m between the index contours
- Map projection : BFTM
- Map sheet neatline : 15' intervals both in the longitudinal and latitudinal directions

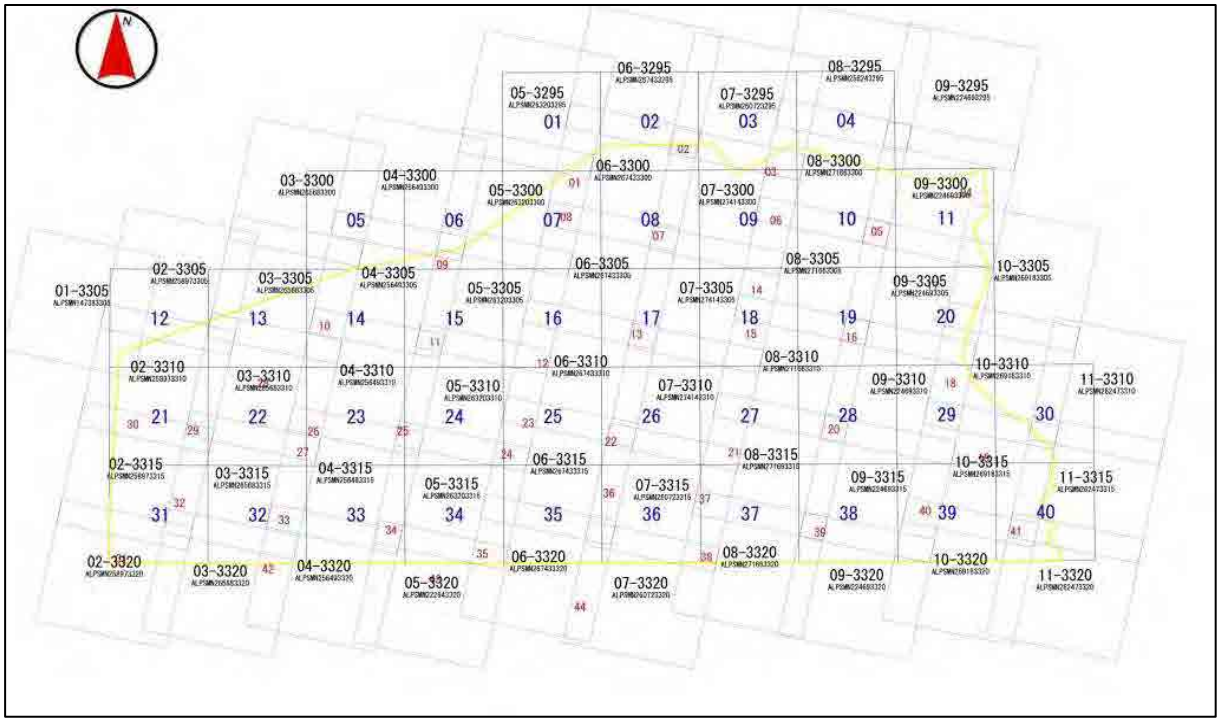


Figure 2-6 Map of digital plotting/compilation sheet divisions (North Block)

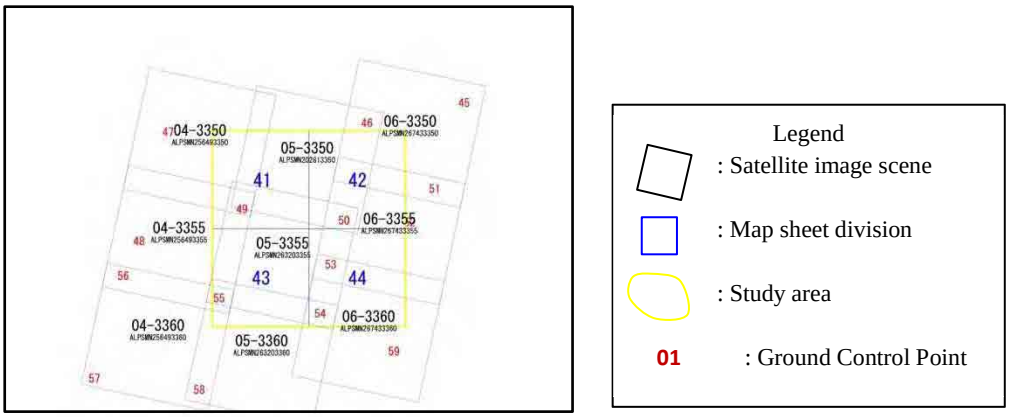


Figure 2-7 Map of digital plotting/compilation sheet divisions (Ouagadougou Block)

[Equipment used]

Digital plotter : LPS (Leica)
: Summit (DAT/EM)

[Data used]

The following were the main data and reference materials used in the plotting:

- Preliminary interpretation maps of vegetation, topography, etc.
- Pan-sharpened orthophotos
- Collected materials
- Field identification photos (kmz photographic data file of planimetric features taken on the ground)
- Map symbol specifications (standards for acquisition of data of planimetric features)
- Resource files specifying line types, etc.
- Photographs depicting conditions on the ground
- Map sheet data

2.9.2 Digital Compilation

The following specifications were used in the digital compilation:

- Specification
  - Compilation scale : 1/50,000
  - Compilation area : approx. 26,000 km^2
  - Compilation sheet number : 40 sheets
  - Map sheet neatline : 15' intervals both in the east-west direction (approx. 26.8 km) and in the north-south direction (approx. 27.7 km)

- Equipment used

  CAD for compilation : MicroStation V8 (Bentley)

- Digital compilation

  Data on annotations and administrative boundaries derived from the following reference materials were added to the output of the digital plotting.

  1) Field identification photographs (kmz file data of photographs of planimetric features taken on the ground)
  2) Existing topographic maps (1/50,000)
  3) Existing data (SHP files)
  4) Data on classes of roads
  5) Areas and names of villages
  6) Field verification subjects

- Output of the Digital Compilation

  The digital compilation data were created with MicroStation V8 of Bentley (in the DGN file format).

[Digital Compilation after Field Verification]

The specifications described below were used in the digital compilation after field verification.

- Specification
  - Compilation scale : 1/50,000
  - Compilation area : approx. 26,000 km^2
  - Compilation sheet number : 40 sheets
  - Map sheet neatline : 15' intervals both in the east-west direction (approx. 26.8 km) and in the north-south direction (approx. 27.7 km)

- Equipment used

  CAD for compilation : MicroStation V8 (Bentley)

- Digital compilation after field verification

  The outputs of the field verification mentioned below were used as the basic data of the digital compilation after field verification.

  1) Road tracking data (for identification of village names)
  2) Results of the field verification

- Details

  1) Utilization of the road tracking data (for identification of village names)

  The track of the vehicle used in the field verification was recorded with a GPS device. Names of villages along the track studied in the verification were also recorded. Then, the data of village names were used to identify villages whose names had remained unidentified before the field verification.

2) Entry of Other Field Verification Results

Data of planimetric features identified as requiring verification in the digital compilation were corrected in accordance with the results of the verification.

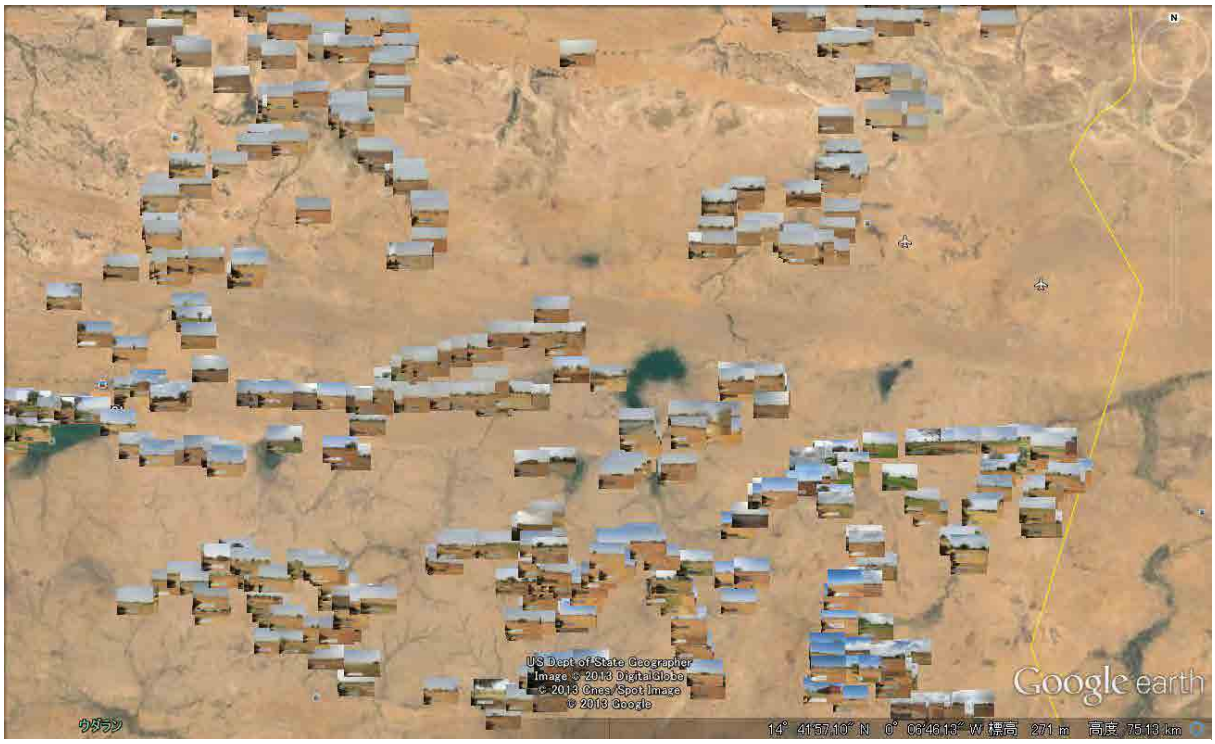


Figure 2-8 Photographs of planimetric features taken with a GPS camera and the result of the verification of their locations

- Outputs of the digital compilation after field verification

The output data of the digital compilation after field verification were created with MicroStation V8 of Bentley (in the DGN file format).

2.10 (15) GIS Data Structurization (Work in Japan)

The format of the output data of the digital compilation after field verification was converted into a data format supported by GIS and data compilation required for the conversion (structured compilation) was carried out.

[Data structurization]

In the data structurization, the output data of the digital compilation after field verification were checked and corrected for logical inconsistency for data structurization with no geometric or topological inconsistency.

a) Logical check

The data were checked and corrected with the logical check function of the software and processed for creation of polygons.

b) Topological Structurization

Topological structurization, or classification of all planimetric features in the output data of the structured compilation into point, line and polygon data, was carried out in accordance with the format rules. After creating polygons, the output data were inspected visually for consistency with the feature classification rule, etc.

[Creation of GIS data]

The output data of the structurization were converted into SHAPE file format in accordance with the specifications mentioned below.

- File format : SHAPE format
- Attributes : Name, classification code, etc. (see the map symbol specifications)
- Data division unit : District (a total of 15 divisions)
- File unit : One SHAPE file per each map symbol item
- Geographic coordinate system : ITRF2008
- Map projection : BFTM
- Reference ellipsoid : GRS80
- Coordinate unit : Meter

2.11 (14) Symbolization/Compilation (Work in Japan)

- Specification
  - Map symbolization scale : 1/50,000
  - Map-symbolized area : approx. 26,000 km^2
  - Number of map-symbolized sheets : 44 sheets
  - Map sheet neatline : 15' intervals both in the east-west direction (approx. 26.8 km) and in the north-south direction (approx. 27.7 km)

- Equipment used
  - CAD for map symbolization : MicroStation V8 (Bentley)
    : Bentley MAP (Bentley)
  - Creation of symbolized map data : Adobe Illustrator (Adobe)

- Symbolization of topographic maps

The output data of the digital compilation after field verification were used for the map symbolization, which consisted of the following:

1) Data structurization for map symbolization;
2) Preparation of a marginal information; and
3) Map symbolization.

- Details

1) Data structurization for map symbolization
2) Preparation of a marginal information
3) Map symbolization

- Outputs of the map symbolization

The output data of the map symbolization were created in Adobe Illustrator (AI) data format.

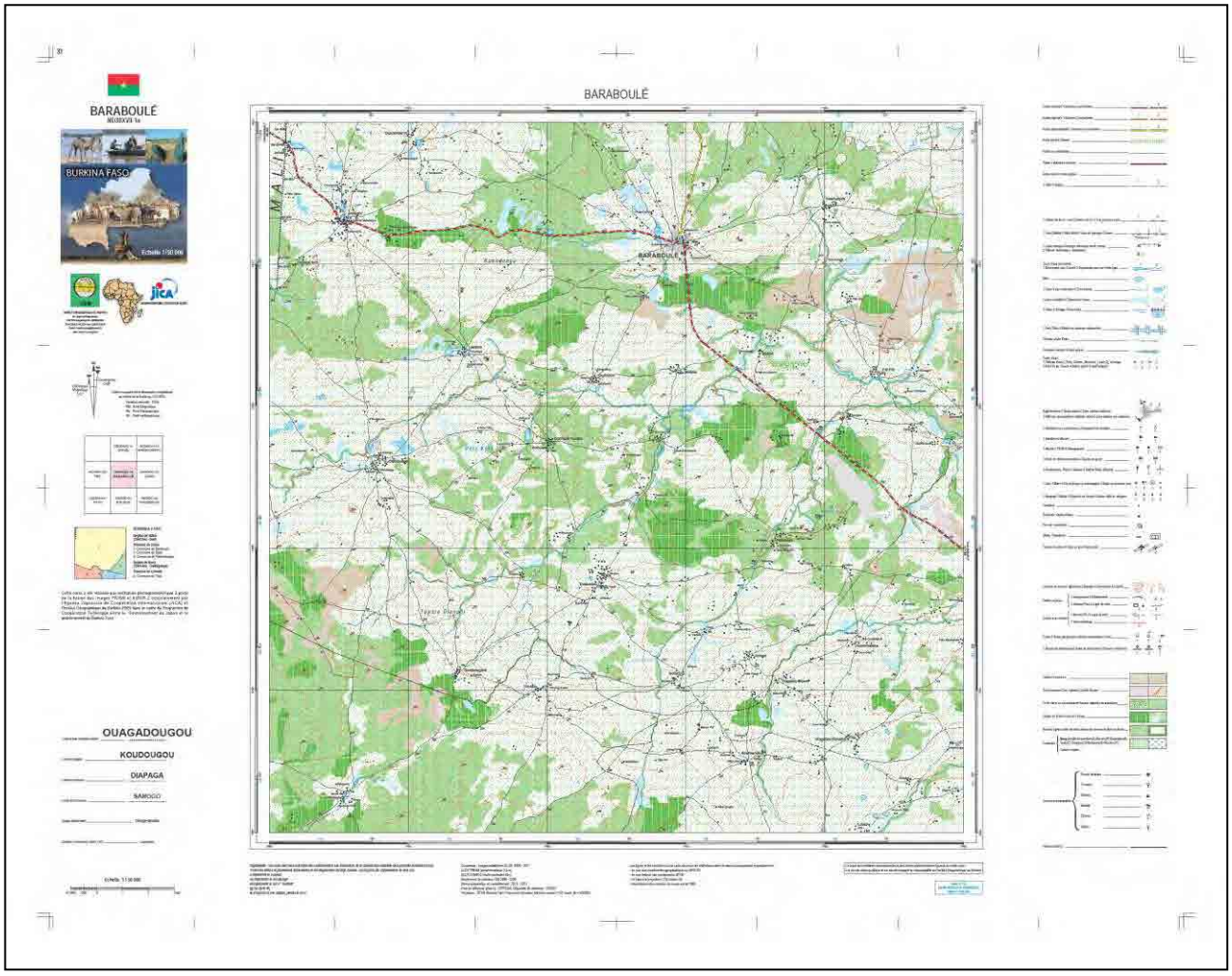


Figure 2-9 A topographic map after the map symbolization (ND30XII-1a)

[Quality control]

Each map sheet was inspected at each of the stages mentioned below and the results of the inspection were compiled in accuracy control tables.

- Digital plotting
- Digital compilation
- Map symbolization

Quantities of omissions and erroneous entries were recorded by type of feature. The correction was made on the omissions and errors detected in the inspection at each stage before the data were used in subsequent stages.

2.12 (16) Creation of Data Files (Work in Japan)

The output data of the data structurization and map symbolization were created as topographic map data and GIS basic data, respectively, in the data formats mentioned below.

- Topographic map data : PDF and AI file formats, by map sheet
- GIS basic data : SHAPE file format, by Department
- Output data of structured compilation : DGN and DWG file formats, by map sheet

2.13 (17) Printing of Topographic Maps (Work in Burkina Faso)

Since IGB has had no printing equipment, it has had to contract out the printing of maps. However, as there was no printing company in Burkina Faso, the map printing work in this project was contracted out to the company in Niger mentioned below.

Name of the company	: NOUVELLE IMPRIMERIE du NIGER
Representative	: Mr. Maman ABOU
Address	: Place du Petit Marche, face Pharmacie de L'Espoir
	Additional: Quartier Terminus, BP 12015, City Niamey, NIGER
TEL	: +227-20 73 47 98
	+227-20 73 52 78
	+227 20 73 46 36
E-mail	: nin@intnet.ne

In the printing process in this project, 8,800 map sheets (200 copies each of the 40 sheets) were to be printed in two weeks. All those map sheets to be output were printed and delivered to IGB within this time period.

2.14 Creation of Orthophotos

DEMs were obtained with the stereo matching function of the plotting system using control point elements obtained from aerial triangulation. The obtained DEMs and nadir view images from ALOS/PRISM were used for the creation of the orthophoto data. Color orthophotos were obtained by the pan sharpening method using ALOS/AVNIR-2 color images. DEMs were for creation of orthophoto data; DEMs were not used for automatic generation of contour lines. The figure below shows the area covered by the created orthophotos.

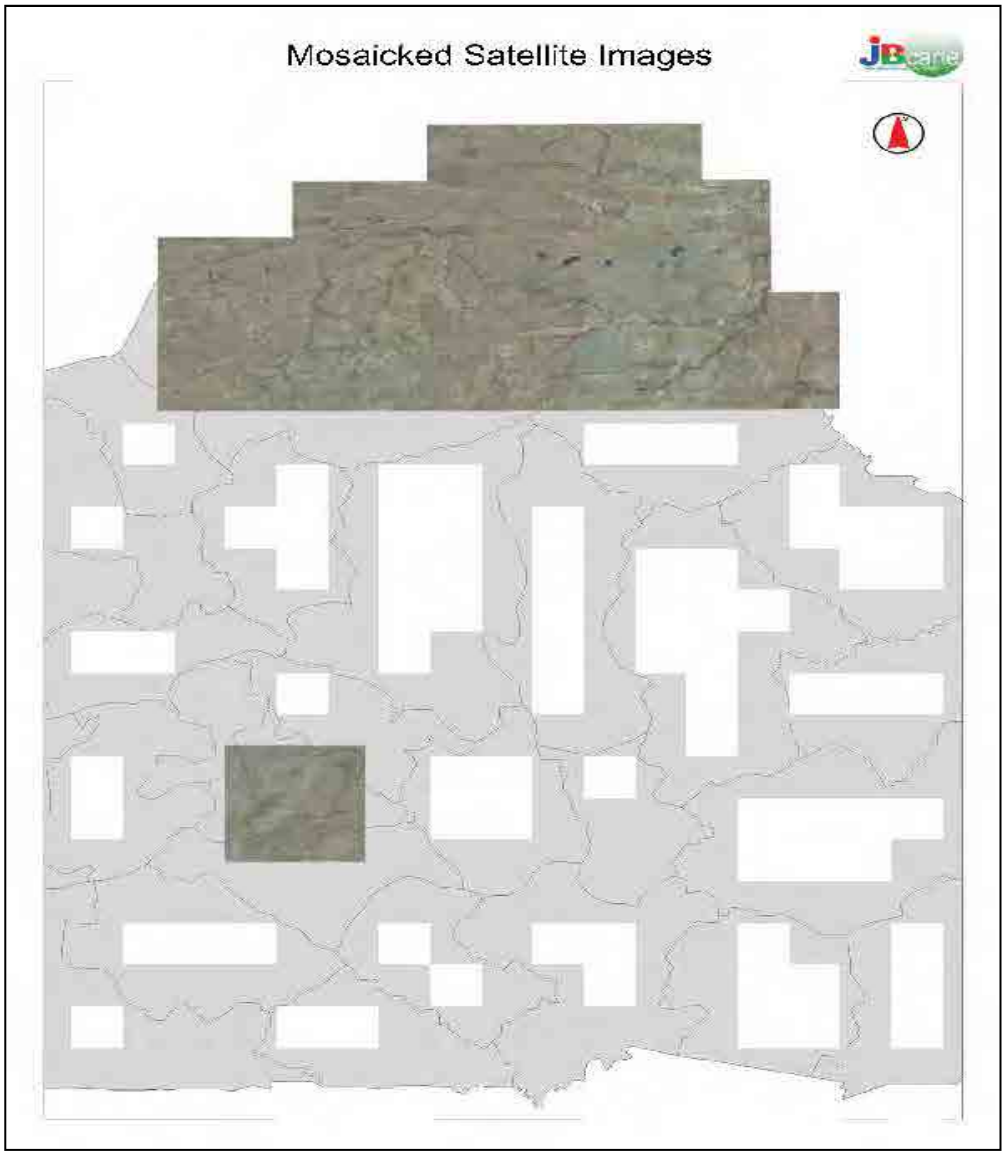


Figure 2-10 Area covered by created orthophotos

2.15 Presentation Ceremony of the Topographic Maps

The topographic maps created in the Project were presented to the Government of Burkina Faso at the conclusion of the Project. The presentation ceremony was well attended by more than 70 people, including the Parliamentary Vice-Minister for Foreign Affairs of the Government of Japan, Mr. Ishihara, the Minister of Infrastructure, Development and Transport of the Government of Burkina Faso and many other senior government officials of Burkina Faso. The following is the summary of the ceremony.

1. Date and time: July 1, 2014 from 16:00 to 17:00
2. Venue: The Chamber of Commerce and Industry of the City of Ouagadougou
3. Sponsors: IGB and JICA
4. Attendees: See the list of attendees
5. Purposes: To notify the general public of the existence of topographic map data of Northern Burkina Faso and Ouagadougou and its environs created in this project and to facilitate the use of the data for development and survey activities in future in Burkina Faso through this publicity activity

Photo 2-12 Presentation Ceremony of the Topographic Maps (from left to right: Mr. Morishita, Chief Representative of JICA Burkina Faso Office, Mr. Ishihara, Parliamentary Vice-Minister, Mr. Ouedraogo, Minister of Infrastructure, Development and Transport, Mr. Futaishi, Ambassador of Japan to Burkina Faso and Mr. Tapsoba, Director General of IGB)

Photo 2-13 The Parliamentary Vice-Minister, Mr. Ishihara, Presents a Topographic Map to the Minister of Infrastructure, Development and Transport, Mr. Ouedraogo

【Program of the Presentation Ceremony】

16:00 Reception
16:15 Address of the Parliamentary Vice-Minister for Foreign Affairs of the Government of Japan, Mr. Ishihara 5 min.
16:20 Address of the Minister of Infrastructure, Development and Transport of the Government of Burkina Faso, Mr. Ouedraogo 10 min.
16:30 Press conference
16:50 *Pause-café* (Coffee break)

Photo 2-14 The Minister of Infrastructure, Development and Transport, Mr. Ouedraogo, and the Parliamentary Vice-Minister, Mr. Ishihara, Inspect the Training Room of the IGB Project

Photo 2-15 The Assistant Team Leader of the Project, Mr. Ikeda, Explains the Topographic Maps to the Parliamentary Vice-Minister, Mr. Ishihara, during the Coffee Break

Table 2-5 List of Prticipated Organization to the Presentation ceremony

No.	Organizations
1	Mr. Hirotaka ISHIHARA, Parliamentary Vice-Ministar for foreign Affairs Member, The House of Representative
2	Minister of Infrastructure, Development and Transport
3	Minister of Housing and Urban development
4	Technical Advisor to the Minister of Infrastructure, Development and Transport
5	Minister of Territorial Administration and Decentralization
6	Minister of Youth and Employment
7	Deputy Minister of Transport
8	The Chef of the Defense Staff
9	Mr. KITAGAWA, Excutive Assistant to Mr. Hirotaka ISHIHARA
10	Mr.ISHIMARU, Principal Deputy Director First Africa Division African Affairs Department
11	Embassies : Mr. FUTAISHI Plenipotentiary, Ms. KAMEDA 3rd Secretary,
12	Embassy, France – European Union
13	UEMOA
14	Members of National Commission on Toponymy (DGPC, BNSP, ISTIC, INSD, ISS, Geography, history, linguistics, DRINA) (09)
15	General Direction of Urban development and Topography (DGUT)
16	General Direction of Taxes (DGI)
17	IFN (National Forest Inventory) Project Coordinator
18	General Direction of Land Development and Decentralization Support (DGAT/AD)
19	General Direction of Local and Regional Land Development (DGAT/DL)
20	Permanent Secretariat of National Council for the Environment and Sustainable Development
21	General Direction of Mines and Geology of Burkina
22	General Direction of National Soil Office
23	Advanced Research Institute of Demography, Ouagadougou University
24	General Direction of National Institute for Environment and Agricultural Research
25	General Direction of Water Resources
26	General Director of National Tourism Office
27	General Direction of Cooperation
28	General Direction of Land Administration (DGAT/MATS)
29	Members of the Board of Directors of IGB
30	Directions of Ministry of Infrastructures of Remote areas and Transportations
31	Former General Directors of IGB (Tarnanguida, Bassolé, lohouara)

[Speech by Mr. Hirotaka ISHIHARA, Vice Ministar of Ministry of Freighn Affaires]

Digital Topographic Mapping Project in Burkina Faso
Presentation of the completed map

I consider it a great honor to have the opportunity to participate in this ceremony during my visit to Burkina Faso. It is with great pleasure that I share the stage today with H.E. Mr. Jean Bertin Ouedraogo, Minister of Infrastructure, Development and Transport at this presentation of the topographic map which marks the culmination of the project.

As you all know, Japan and Burkina Faso have a history of friendly relations that spans many years, and Japan has made an active contribution to the development of Burkina Faso through our country's Official Development Assistance.

Making good use of the advanced topographic mapping technologies Japan has developed to the present time, starting in 1971 we have implemented cooperation projects related to mapping in countries all over the world; in Africa, so far we have implemented projects in 23 countries.

The digital topographic maps created in this project will provide a foundation for development programs of all kinds, including urban planning, road maintenance and improvement projects, and projects to improve agricultural land. In addition, in order to enable the continued use and application of topographic maps, in this project the relevant technology was passed on to the technical experts of the Geographic Institute of Burkina Faso. I have great expectations that this cooperation between our two countries will contribute to the sustained development of Burkina Faso.

Furthermore, in this project initiatives were taken in collaboration with UEMOA to help spread topographic map-making techniques throughout West Africa. It is my dearest wish that cooperation within the area will help promote the economic integration of UEMOA.

In this way, Japan has put its expertise to use in implementing cooperation projects based on the needs of Burkina Faso; and it is my hope that I will be able to work to strengthen and enhance still further the relationship between our two countries.

[Speech of the Minister of Infrastructure, Development and Transport]

AT THE PRESENTATION CEREMONY
OF
DIGITAL TOPOGRAPHIC MAPS AT A SCALE OF 1/50,000

- *Ladies, Gentlemen, Members of the Government;*
- *His Excellency, the Ambassador of Japan;*
- *Ladies, Gentlemen, Representatives of Diplomatic Missions and International Organizations;*
- *Dear Collaborators;*
- *Distinguished guests with your respective ranks and titles;*
- *Ladies and Gentlemen;*

Last January, after the delivery of topographic maps at a scale of 1/200,000, updated for the Western half of our country, we are holding another event of similar importance this afternoon, which is the delivery of the digital topographic maps at a scale of 1/50,000.
We wish to thank all the persons who are honoring us with their presence, and I wish to inform you again that the signing of the convention for the production of digital topographic maps for northern part of Burkina Faso, between the Government of our country and the counterpart in Japan, was held in October 2011.
Since then, the staff assigned to implement the project have been working incessantly. These are employees of the Geographic Institute of Burkina Faso (IGB) and the Study Team of Japan International Cooperation Agency (JICA).
In order to assure the installation of production equipment, the training of IGB personnel and the gathering of data required to obtain details taken from satellite images under the kind supervision of the Japanese experts, these teams have worked tirelessly for two years, braving heavy rains, difficult access roads, and at the risk of their own personal safety… in order to comply with the given deadlines.

- *Distinguished Guests;*
- *Ladies and Gentlemen;*

These workers who went over the field, from village to village, hamlet to hamlet, to gather said information from local authorities and the residents, well deserve our heartfelt congratulations. I also wish to thank the Japanese experts who, simply from the sampling stage, were able to very quickly familiarize themselves with the type of land occupation in Burkina Faso, as well as the experts contributed to the success of the project remotely from Japan, without setting foot in Burkina Faso.

Furthermore, in spite of the language barrier, the Japanese experts were able to successfully execute the transfer of skills to the IGB personnel for use of the equipment which is now the property of Burkina Faso. Leadership from Burkina Faso has therefore been reinforced through the Technical Cooperation Project of the Japanese Government.

The concentration of all these efforts has now allowed the use of forty (40) new maps covering Ouagadougou and the northernmost part of our country. For the North area, these maps covered the Djibo, Diguel, Tin-Akof, Markoye, Falangountou, Dori, Arbinda, and Baraboulé communes and for Ouagadougou area, the city and communes of Kombissiri and Saponé.

- *Distinguished Guests;*
- *Ladies and Gentlemen;*

This project has benefited not only our country, but has offered cooperation frameworks for countries in the West African Economic and Monetary Union (UEMOA) for shared concerns, through the two seminars held in Ouagadougou.

The first seminar was held on December 18 and 19, 2012, bringing together the directors general of the cartography departments of UEMOA member countries and Guinea. For the participating countries, this seminar provided the occasion to share experiences with their Japanese colleagues. The West African Economic and Monetary Union has also benefited from this seminar in order to inform the participants of its projects and to express its expectations on national cartography agencies.

The second seminar was organized in February 2014 and, aside from the directors general of mapping agencies, it brought together the managers of geographical data user departments. In this seminar, the participants exchanged the concerns of users in order to better direct map production to their needs.

- *Ladies and Gentlemen;*
- *Distinguished Guests;*

From an estimated amount of more than two billion six hundred million FCFA, the project has provided maps at finer scales, allowing more accurate targets for projects and investment priorities. The production of these maps required the provision of satellite images ALOS PRISM with a geometric resolution of 2.5 meters, together with color images (ALOS/AVNIR2), in order to provide better demarcation of land occupation.

The outputs of this project will be developed through multiple uses such as early alerts and response to disasters, project planning in fields as varied as water, agriculture, health and infrastructures.

I also wish to take this occasion to renew our gratitude and heartfelt thanks to the people and Government of Japan for their multi-form support to Africa in general and to Burkina Faso in particular.

- *To His Excellency, the Ambassador of Japan;*

Along with many African countries, Burkina Faso falls way behind in the field of geo-information. Since our needs remain high in this field, I would like to request that you be our spokesperson to your Government, in order to once again express our gratitude to the generous Japanese people for their efforts to assist Burkina Faso in the mapping of the territory and the training of the staff in Japan. Kindly inform your Government of our needs and concerns, which may eventually be embodied in projects to be submitted to your country.
Before my closing remarks, please allow me to reiterate my encouragement to all IGB personnel who I hope will benefit from this rich experience in order to continue their excellent work on a daily basis.

- *We look forward to more reliable and efficient spatial data acquisition,*
- *As well as a fruitful and lasting cooperation between Burkina Faso and Japan!*

Thank you very much!

Chapter 3 Promotion of Data Utilization Plan

3.1 (18)Promotion of Data Utilization Plan (Work in Burkina Faso)

To promote utilization of map data and GIS data, it is necessary to enhance public relations and develop an environment in which the data is provided. Therefore, the following operation was conducted in accordance with a basic recognition of the status quo and in the issues that are the background of the project.

3.1.1 Holding of Seminars

[Period of Operation]

April 24 to May 28, 2012

[Description of Operation]

Seminars were held as a part of activities in the Study on Data Utilization Plan (Phase 1).

[Purposes of Operation]

The purposes of operation by the utilization plan are as follows:

1) Promoting utilization of topographic map results and carrying out public relation activities
2) Promoting wide-area collaboration for topographic mapping technology, etc.
3) Constructing a system for promoting utilization

[Overview of Operation]

In this Phase 1 study, information was exchanged with and collected from the government agencies of Burkina Faso, output user organizations and national surveying/mapping organizations from UEMOA member countries and Guinea, and the relevant Japanese personnel.

(1) Bureau of Mines and Geology of Burkina (Bureau des Mines et de la Géologie du Burkina)

i) At present, the organization is creating thematic maps such as topographic maps based on 1/200,000 maps. However, it is **urgently required to create thematic maps based on detailed maps (1/50,000)**.
ii) The map data currently used as the basis has been supplied from IGB. Since the organization has a close relationship with IGB, they have great expectations for the results of the project.
iii) Training on GIS-based creation of thematic maps is required (Human resources development is the issue).

[Consideration]

Not only the Bureau of Mines and Geology of Burkina, but the major organizations within Burkina Faso, such as forestry, natural environment, conservation of wildlife, water resources, etc., are

working on developing thematic maps using GIS, based on the geospatial information (hereinafter referred to as "map") data being prepared by IGB. The thematic maps will be heavily used for analysis of planar areas, and structured map data is suitable for use, so it is considered that the method of transmission and supply of the maps from the producer IGB will be important.

(2) UEMOA: Union Economique et Monétaire Ouest Africaine (West African Economic and Monetary Union)

i) They are aware of the necessity of the development of maps from the point of view of regional development, but because of the lack of technicians there has been no specific progress in that discussion. However, the officer in charge understood the effectiveness of technology transfer through the map production project and the importance of linking up with IGB.

ii) Around October 2013 a technician was scheduled to be appointed, who would then make contacts and discussion regarding detailed matters in connection with map development.

iii) It is necessary that the technical capabilities be levelized in the participating regions, and technical workshop meetings are necessary, through the technical seminar for wide-area collaboration. Technical workshop meetings are necessary. Also, participation will not necessarily be limited to UEMOA member countries, but it was declared that there was agreement that non-member countries could participate. (Participation of Guinea and Ghana is being considered.)

[Consideration]

UEMOA is an organization that takes measures to stabilize the West African region (CFA franc currency countries). Hence they hold various seminars and workshops aimed at stable development of the region, and hold management training, and have constructed a strong shared network in these fields.

Using the UEMOA network which is already constructed is a good approach to raising awareness for the utilization of the mapping field, and it is necessary to propose cooperation regarding holding a technical seminar for wide-area collaboration in December. In addition efforts should be made to share various kinds of information through JICA experts dispatched to UEMOA, which is considered to be the necessary impetus for the promotion of map development and awareness of their use in the West Africa region.

(3) Holding of Meeting about Maps

The staff of the Japanese Embassy in Burkina Faso and people related to JICA were invited to an explanatory meeting about maps as a map promotional activity.

[Objectives]

The objective of this explanatory meeting was to provide relevant Japanese personnel in Burkina Faso with an overview of this project, and to provide explanations and impart understanding regarding the basics of viewing and reading maps, etc., and the future trends in geospatial information.

[Expected Effect]

By making Japanese personnel with local connections, such as experts, volunteers, etc., aware of the map information, it was expected that it would promote awareness of the existence of the maps among relevant local persons, and promote their use.

[Issues and Measures]

As the number of volunteers and experts that participated was small, in the future an explanatory meeting will be held again at the completion of the project, after making sufficient contacts.

[Outline of the Meeting]

- Date and time : Friday, May 18, 2012 16:00 – 17:30
- Place of venue : Conference Room, JICA Burkina Faso Office
- Contents explained:
  - Discussion about maps: Viewing and reading maps, explanation of map symbols, etc.
  - Summary of the JBcarte map project: Summary of the project that is now ongoing
  - Geospatial information in the future: The status of the latest map development in progress in Japan was introduced through the work of the Geospatial Information Authority of Japan. (Preparation of electronic basic maps of the national land from the basic map information.)

[Consideration]

By explaining the outline of the map project to relevant Japanese persons in Burkina Faso before informing the people of Burkina Faso, it was expected that there would be a propagation effect regarding the features, interesting points, and uses of maps at the workplaces of the Japanese persons that have participated.

In the future, when the maps are completed, the participants can take the initiative in using the maps in their work, and promote the use of the data at each government organization, in school education, medical treatment, water supply, agriculture, etc.

(4) Opening Seminar (Project Kickoff)

At the start of the project, an opening seminar was held as follows:

- Date and time : Friday, May 25, 2012 08:30 – 11:30
- Location : IGB
- Attendance : About 100 persons
- Speeches (in order of speeches) : Director General of IGB

Chief Representative of JICA Burkina Faso Office
Japanese ambassador to Burkina Faso
Administrative Vice-Minister of Ministry of Infrastructure, Burkina Faso

[Overview]

In order to publicize the start (kick off) of the project, about 100 persons were invited to the counterpart organization, Institut Géographique du Burkina (IGB) for the kick off seminar.

Photo 3-1 Mr. Tapsoba, Director General of IGB

Photo 3-2 Mr. Sugiura, Ambassador Plenipotentiary

Photo 3-3 Administrative Vice Minister of the Government of Burkina Faso

Photo 3-4 EU ambassador and Ms. Harada, Second Secretary

Photo 3-5 Mr. Moriya, Chief Representative of JICA Burkina Faso Office

Photo 3-6 Panel explanation by Mr. Belem, IGB Technical Director

(5) Map User Meeting

[Objectives]

This meeting was held with the objectives of giving the various organizations within Burkina Faso that are anticipating using the map data from IGB an understanding of the project specification, etc., and to hear the opinions on the methods of providing the data to suit the convenience of the users.

[List of participating organizations]

Participating organizations are as follows.

- Bureau of Mines and Geology of Burkina
- National Council for Combating Desertification
- Bureau of Environment and Development (Project for Support of Seedling Production)
- National Institute of Soil
- Institute of Demography
- International Institute of Water Environmental Engineering
- Private Consultant
- Institute of Agricultural Environment

Photo 3-7 Data user meeting

[Outline]

This meeting was mainly attended by working level participants from organizations invited in advance by IGB as candidate users. First, IGB explained the project in outline, so that the participants could understand the objectives, specification, etc.

[Consideration]

The implementation plan for this project does not include a work item for the construction of a website, but the Study Team also considers that it is necessary to introduce a website as a tool for efficient promotion of the use of the project.

3.1.2 Information Collection from Topographic Map User Organizations (Work in Burkina Faso)

[Period of Operation]

September 25 to November 2, 2013

[Description of Operation]

The Study Team investigated the current state of the utilization of topographic map data by conducting a questionnaire inquiry and, later, an interview survey of the major map user organizations in Burkina Faso. The Study Team visited the major user organizations mentioned below for the interview survey.

- Department of Environmental Economics and Statistics/Ministry of Environment and Sustainable Development : (DEES/MEDD)
- National Institute for Environment and Agricultural Research : (INERA)
- General Directorate of Mining, Geology and Quarries : (MINING)
- Division of Capacity Development, Information and Environmental Monitoring/National Council for Environment and Sustainable Development : (DCIME/CONNED)
- General Directorate of Soil : (SOIL)
- International Institute for Water and Environmental Engineering : (2IE)
- Private map consultants

[Consideration]

The Study Team visited the major topographic map user organizations in Burkina Faso and learned in the interview survey the current state that those organizations endeavored to create thematic maps using the 1/50,000 (analog) topographic maps while maintaining close working relationship with IGB. However, all those organizations were using the time-consuming and low-accuracy method of tracing maps manually on pieces of tracing paper placed on analog (printed) maps. As the digital map creation method will be readily available after the completion of this project, it will become possible for them to create accurate thematic maps in a short period of time.

3.1.3 Construction of Website (Work in Japan and Burkina Faso)

At present, map users in Burkina Faso purchase maps that they require after having confirmed availability of such maps by making inquiries to IGB by telephone or visiting IGB and browsing around their stocks. This data delivery system is no longer practical because of the personnel cost required for the data delivery process in IGB. Introducing a website can be expected to have a big effect on solving these problems. The requirements for providing data at present are as follows.

- Publicizing the status of development of geospatial information
- Providing the latest data
- Rapid provision of data

By achieving data transmission through a website, it is considered that the current distribution process can be simplified as shown below.

(Current map and data distribution method)

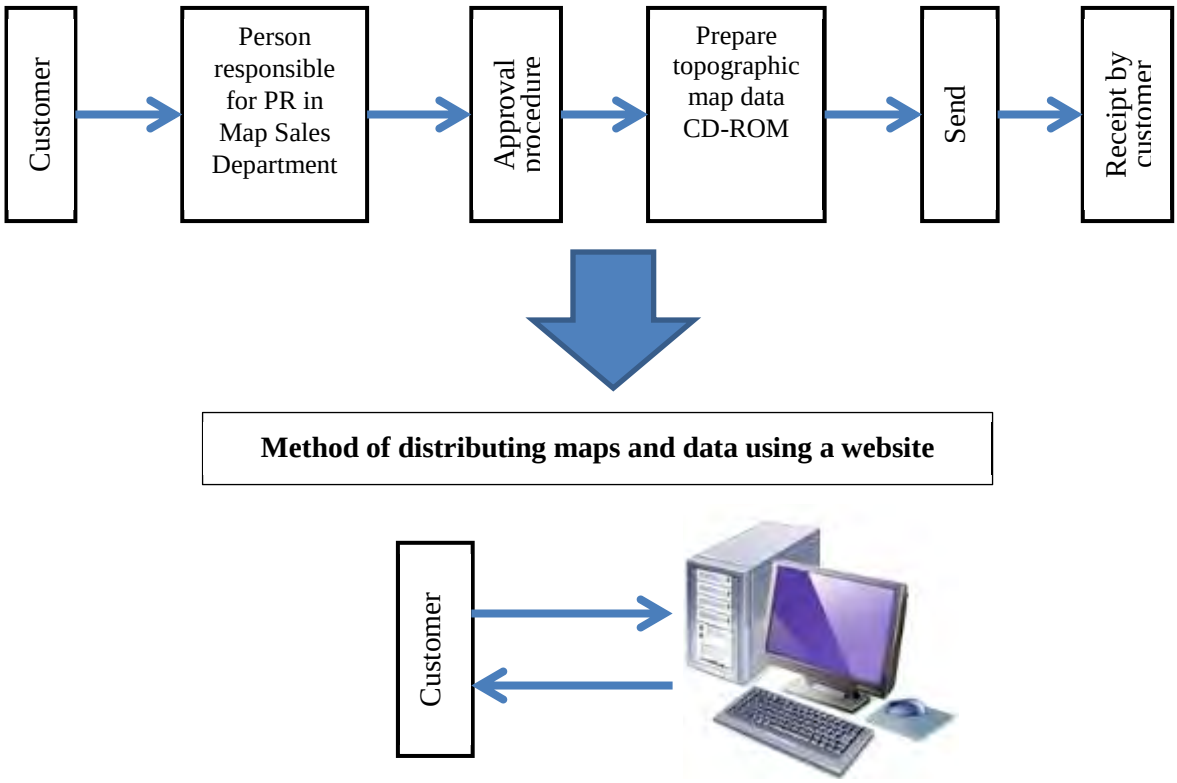


Figure 3-1 Comparison of data distribution methods

[Outline of the website construction]

The Study Team carried out the work required for the construction of a website for downloading and browsing digital topographic maps with the WebGIS technology in order to promote utilization of the project outputs.

[Implementation policies for the website construction]

Since the website being operated by IGB (http://www.igb.bf) is not implemented with functions

required for dynamic display of maps or a data delivery function enabling provision of geospatial information data, the website is to be reconstructed with implementation of such functions.

[Work in Burkina Faso Phase 1: July – August 2013]

In the first phase of Work in Burkina Faso, the Study Team studied the status of infrastructure development in Burkina Faso and conditions of various facilities in IGB and collected information to be used for the discussion on the details of the work for the website construction. In this phase, the Study Team studied the conditions in the field and held discussion on strategies for the renewal of the existing IGB website with IGB with the aim of implementing the above-mentioned functions on the website.

IGB was to complete the development of a system to display maps with web mapping from the trial system, while the Study Team was to develop a data download system and a simple ordering system.

[Work in Burkina Faso Phase 2: January – February 2014]

The Study Team made the data download system and the simple ordering system, created in accordance with the required specifications, operational on the website of IGB, made final adjustments to the data entry system and transferred technologies used for the system maintenance to the engineers in charge of the maintenance of the counterpart organization, IGB, in Phase 2 of the Work in Burkina Faso.

Prior to the final adjustments and the technology transfer, the team also installed applications including a web server application and a content management system (CMS) on the server equipment procured in this project and set up the system configurations of the equipment.

Tasks for configuring the Web server, it was assumed the combination of Apache, PHP, the MySQL as the OS WindowsServer2012 this time, but the engineer in charge was like being unfamiliar to setting individual applications of these. Aafter all, it was to be carried out at the initiative of Study team. In addition to the standard combination, due to PHP configuration libraries required for the download system created in this project, the explanatory material was also created or the sudden requirement in future.

[Work in Japan]

The Study Team developed the systems in Japan in accordance with pre-determined specifications using the following procedures:

1. Development of a draft layout of each web page
2. Study on data to be on each page
3. Study on functions to be installed on the website
4. Creation of frames in each web page
5. Implementation of the website

3.2 (19) First Technical Seminar for Wide-Area Collaboration

Burkina Faso is the leading country in the West Africa region in map making technology, so a technical seminar for wide-area collaboration was held inviting nearby countries, in particular UEMOA (West African Economic and Monetary Union) member countries, with the objectives of the various issues in the organization and sharing solutions.

[Day 1, 1st Technical Seminar for Wide-Area Collaboration about Geospatial Information in Burkina Faso]

On two days, December 18 and 19, 2012, the first Technical Seminar for Wide-Area Collaboration was held by JICA and IGB as the hosts and UEMOA as the sponsor.

The representatives that participated were the heads and the persons responsible for technical departments of national surveying and mapping organizations from 9 countries (Benin, Burkina Faso, Côte d'Ivoire, Guinea-Bissau, Guinea, Mali, Niger, Senegal, Togo), and relevant persons from the Japanese side, including the Geospatial Information Authority of Japan, JICA, and private surveying companies.

Photo 3-8 JICA Burkina Faso Office and UEMOA

Photo 3-9 Major participants in the Seminar

[Seminar Participant List]

Table 3-1 Seminar participant list (UEMOA Member Countries and Guinea)

18 to 19 December 2012

Name of participant	Country	Contact
COULIBALY Aliou Adama	Mali	aliouigm@yahoo.fr
KOUNGOULBA Abdoudourahman	Mali	aboudrakoungoulba@yahoo.fr
ENONZAN Nounagnon	Benin	adoenonzan@yahoo.fr +229 95953114
ABATAN Hubert	Benin	hubatan2005@yahoo.fr +229 95063887 / 97645605
M'BRA KOUADIO Sévérin	Côte d'Ivoire	mbrasev@yahoo.fr

		+225 01054951
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DA SILVA NHGA Nhaga Herculano	Guinée Bissau	Herdasy10@yahoo.es +245 6752130
FOFANA Mohamed Hassimiou	Guinée	mhasfofana@yahoo.fr +224 65518206
CONDE Mamady	Guinée	Mamadyconde562004@yahoo.fr +224 64200582
MATO Harouna	Niger	Mato_harouna@yahoo.fr +227 90452425
HASSANE Tahirou Amadou	Niger	Tahirou_h2008@yahoo.fr +227 99883171
NDONG Youssou	Sénégal	dirdtgc@orange.sn +221 776430178
TIAM Mamadou	Sénégal	thiammor@hotmail.com +221 776596033
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KOUEDAKOR Anoumou A.	Togo	riomario318@hotmail.com +228 99175034
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KONATE Abdel Aziz	Burkina	Abdelaziz.konate@yahoo.fr +226 77552222
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YAO Maïmouna	Burkina	ymmouna@yahoo.fr +226 70530576
SANON Oumar Issa	Burkina	oi_sanon@yahoo.fr +226 70264795
BOLLY Ahmadou	Union Européenne	Ahmadou.bolly@ec.europe.eu +226 78 64 03 07
FATY Mélany	UEMOA	mfaty@uemoa.int +226 76819261
CAMARA Mame Marie Monteiro	UEMOA	mmbcamara@uemoa.int +226 72133089
TOMOMI Tokuori	UEMOA	ttkuori@uemoa.int +226 96690205

Table 3-2 Seminar participant list (GSI, Private consultants of Japan)

Name of participant	Organization	Email address
MASAHARU Hiroshi	IGN Japon/ Ministère du Territoire, des Infrastructures, des Transports et du Tourisme Analyseur des Nouvelles Technologies pour la mise à jour des informations des cartes de base	masaharu@gsi.go.jp
OKAZAKI Yuji	Directeur du Bureau d'OKAZAKI	okazaki0416@gmail.com
TAKANO Sho	JICA/Département de l'Infrastructure	Takano.Sho@jica.go.jp

	Economique Division 1 du Groupe de Construction de la paix et Développement Urbain et Régional	
HARADA Takashi	AEROASAHI SA, Equipe d'étude du Projet de production de Carte Topographique Numérique du Burkina Faso	kashyhz@gmail.com Tel : +226 77 633330
IKEDA Takao	AEROASAHI SA, Equipe d'étude du Projet de production de Carte Topographique Numérique du Burkina Faso	takao.ikeda@gmail.com Tel :+226 75 708662
IWASE Mitsuo	Infrastructure Développement Infrastructure Collaborateur de l'Equipe d'étude du Projet de production de Carte Topographique Numérique du Burkina Faso	5bu00@idi.or.jp +226 77 923232
OUCHI Yuji	AEROASAHI SA, Equipe d'étude du Projet de production de Carte Topographique Numérique du Burkina Faso	yuuji-oouchi@aeroasahi.co.jp +226 75 708496
OKADA Noboru	Equipe d'étude du Projet de production de Carte Topographique Numérique du Burkina Faso	nbrokd@xa2.so-net.ne.jp
	Sociétés Japonaises participantes au séminaire	
TSUDA Kaoru	PASCO SA, Directeur du Département Commercial	kaadou2907@pasco.co.jp
FUKUOKA Hayato	PASCO SA	haakyo2213@pasco.co.jp
MATSUMOTO Hitoshi	ASIA AIR SURVEY CO., LTD. Directeur Adjoint du Dep. Commercial et Marketing	hts.matsumoto@ajiko.co.jp
TOMIMURA Shunsuke	ASIA AIR SURVEY CO., LTD.	shu.tomimura@ajiko.co.jp
ISHIJIMA Norio	KOKUSAI KOGYO CO., LTD. Directeur de Div. de Développement de Projet	norio_ishijima@kk-grp.jp
KIKUCHI Kosuke	KOKUSAI KOGYO CO., LTD.	Kosuke_kikuchi@kk-grp.jp

Table 3-3 Seminar participant list (Embassy, JICA, UEMOA)

JAPAN EMBASSY

Mr. SUGIURA Tsutomu	Ambassador
Ms. HARADA Norie	Second Secretary

JICA OFFICE

Mr. MORISHITA Hiromichi	Représentant Résident de la JICA
Ms. NDIAYE HAYASHI Emiko	Adjointe au Représentant Résident
Mr. GANSORE Cheik	Chargé de programme

UEMOA

Ms. TOKUORI Tomomi	Conseillère à la Coordination des Projets TICAD pour le Développement des Infrastructures et de l'Energie

	L'Expert de la JICA

[Day 2, Wednesday, December 19: Special Program] M.C.: JICA

Interview survey : On the problems in the past map projects and issues need to be solved in the future

Coordinator : JICA

Participants : NMOs, JICA, Geospatial Information Authority, private air survey company

[Output]

There was agreement on a recognition that in order to solve the various problems associated with development of geographical spatial information and promotion of human resource development in the West Africa region, a strong network should be constructed between the participating countries and information should be shared.

[Consideration]

Based on the presentations at the wide-area technical collaboration seminar, the common issues in the NMOs of each country are considered to be the following 4 points.

i) Obtaining budget
ii) Development of human resources
iii) Provision of equipment
iv) Organizational strengthening

(Text of the speech by Mr. Tapsoba, Director General of IGB, Burkina Faso)

(English translation)

Seminary of the Countries Member Countries of UEMOA and Guinea on the Geographical Information
Ouagadougou, December 18 and 19, 2012

Resolution regarding creation of a Network of the Institutes and Organizations for production of basic geographical data

Considering that quality infrastructure of geographical data constitutes an indispensable support for the economic development of their respective countries,

The General managers and Directors of the agencies for production of basic geographical data of the

member countries of UEMOA and Guinea, united at the seminar on the geographical information in Ouagadougou on December 18 and 19, 2012, and

Decide to create, with the support of the JICA and the UEMOA, a Network of the agencies in charge of the production of the basic geographical data in order to advance the sciences and techniques of geographical information in their region and to promote good practices in their respective countries.

Made in Ouagadougou, December 19, 2012

The Seminar

3.3 Lecture Tour

IGB and the Study Team conducted a “lecture tour” to an elementary school in Ouagadougou, as an activity to extend the use of maps. The outline of the tour is mentioned below.

Photo 3-10 Lecture by Mr. Bako of IGB in the lecture tour

Photo 3-11 Pupils listening to a lecture and participating in a practice in the lecture tour

[Outline]

1. Organizers: IGB (Geographic Institute of Burkina Faso) and JICA
2. Venue: Paspanga D Elementary School
3. Date : Friday, February 7, 2014
4. Participants : 5th and 6th graders of the school 93
   Class teachers and the officials concerned of the Education Supervisory Bureau 26
   Total of 119
5. Objective : To raise the interest in maps and improve the knowledge of maps of elementary school pupils (in the upper grades) by making them realize the importance of maps as a tool to learn information on their land.
6. Impact : The interest of the pupils in the work related to map creation and surveying required for the map creation will be raised after they become interested in maps and learn about them.
7. Program (contents)

10:30 Presentation of gifts including maps of Burkina Faso to the officer in charge of the Education Supervisory Bureau and the principal of the elementary school

10:35 Lecture by a staff member of IGB, Mr. Bako

(1) Presentation on the services provided by IGB

(2) Presentation on topographic and thematic maps (at the scales of 1/50,000 and 1/200,000)

(3) Explanation of map symbols (including those for roads, buildings and railroads)

11:00 DVD presentation on how to create maps
(A DVD produced by the Geospatial Information Authority of Japan was used)

11:30 Question-and-answer session (using questionnaires)

12:00 Conclusion

8. Consideration

- The team members were impressed by the eagerness of the pupils who listened to the lecture attentively and took notes from it. The lecture seems to have left a significant impression on the pupils as it provided many of them with the first opportunity to see actual maps.
- The lecture also seems to have had a strong impression on the teachers, as well as the pupils, as they requested a lecture on the same topic for teachers.
- This lecture tour should be regarded as the first of a series of lecture tours which should be conducted continuously in the future. The Study Team recommended the continuation of the lecture tours to IGB.
- The lecture tour is a simple but very effective publicity activity. Cooperation to conduct such tours seems to be likely to be found in the actual field of education.
  (Members of JOCV provided the team with assistance in selecting the target school.)

3.4 2nd UEMOA Technical Seminar for Wide-Area Collaboration

The First Technical Seminar for Wide-Area Collaboration about Geospatial Information in Burkina Faso was held in Ouagadougou, Burkina Faso, on December 18, 2012. The representatives of the national mapping organizations (NMOs) of nine countries, the eight UEMOA member countries and Guinea participated in the seminar. The theme of the seminar was “To create a common understanding of the current state of the NMOs in West Africa and the problems faced by them and to find solutions to the problems which all of them can use.” The participants agreed on “the creation of a mutual cooperation network for the development of geospatial information" in the seminar. On the basis of the agreement, the Second Technical Seminar for Wide-Area Collaboration about Geospatial Information in Burkina Faso was held again in Ouagadougou on February 13 and 14, 2014, simultaneously with a seminar for the promotion of data utilization.

1. Objective

This seminar was intended to contribute to the creation of sustainable mutual cooperation for the development of spatial data infrastructure (SDI), which was recognized as an essential data infrastructure for national development and disaster management, in West Africa through the processes of creating a common understanding of the problems faced by each of the NMOs in the region in the development of SDI and finding solutions to the problems which could be used by all of them.

2. Basic information

1) Title of the seminar : Second Technical Seminar for Wide-Area Collaboration about Geospatial Information in Burkina Faso (held simultaneously with a seminar for the promotion of data utilization)
2) Organized by : IGB and JICA
   Supported by : Embassy of Japan in Burkina Faso and UEMOA
3) Date : Thursday, February 13 and Friday, February 14, 2014
4) Venues : Azalaï Hôtel Indépendance, Ouagadougou
5) Participating countries (nine countries): (1) Benin, (2) Burkina Faso, (3) Guinea, (4) Guinea-Bissau, (5) Côte d’Ivoire, (6) Mali, (7) Niger, (8) Senegal and (9) Togo

3. Purposes of the seminar

- To share information on how to utilize SDI effectively with presentations on utilization of SDI in the participating countries by their representatives
- To formulate an action plan through discussion on solutions to the problems which NMOs of the participating countries are facing
- To identify and agree upon the targets of self-help efforts to be made by each of the NMOs of the participating countries

4. Expected outcomes
   - Preparation of an action plan contributing to human resource development (for adopting management technologies and new technologies)
   - Preparation of an action plan contributing to strengthening of the organizational capacity of the NMOs (required for long-term planning of activities)
   - Recognition by the NMOs of the participating countries of common targets of their self-help efforts

Reference:

★NMO: National Mapping Organization

National mapping organization where mapping includes surveying and creation of topographic maps

★Geo-spatial information: SDI (Geo-Spatial Data Information/Spatial Data Infrastructure)

Geo-spatial information consists of positional information and additional information (including elevation, place names, topography and vegetation) that all the objects on the ground surface have. In general, it includes topographic maps, aerial photographs and statistical data. It is frequently used in the GIS (geographic information system)

[Program of UEMOA Technical Seminar for Wide-Area Collaboration]

Program of the Second Technical Seminar for Wide-Area Collaboration about Geospatial Information in Burkina Faso

Theme: Creation and Utilization of Map Data and Associated Problems

1. Organized by : IGB/JICA

2. Supported by : Embassy of Japan and UEMOA

3. Date : Day 1 – Thursday, February 13, 2014 09:00 – 17:00
   Day 2 – Friday, February 14, 2014 09:00 – 15:00

4. Venue: Azalaï Hôtel Indépendance, Ouagadougou

5. Number of expected participants: Opening ceremony approx. 100
   Technical workshop approx. 50

6. Participating countries: Nine
   1) Benin, 2) Burkina Faso, 3) Guinea, 4) Guinea-Bissau, 5) Côte d'Ivoire, 6) Mali, 7) Niger, 8) Senegal and 9) Togo

7. Participants : Two from each country
   - A representative of the NMO
   - An engineer representing an organization utilizing geospatial information and

data in the sector of national land development, mining, agriculture, environmental protection, road or water management

3.4.1 Address by His Excellency, Ambassador Plenipotentiary of Japan, Mr. Futaishi

His Excellency, Ambassador Plenipotentiary of Japan to Burkina Faso, Mr. Futaishi, attended the UEMOA Technical Seminar for Wide-Area Collaboration. The following is the transcript of his address at the seminar.

Photo 3-12 His Excellency, Ambassador Plenipotentiary, Mr. Futaishi at the UEMOA Seminar for Wide-Area Collaboration

This seminar is organized as a part of the technical cooperation project, "Digital Topographic Mapping Project in Burkina Faso," which has been implemented by the Government of Japan since 2012, in cooperation with the Geographic Institute of Burkina Faso (IGB) and UEMOA. Its objectives are creation of a wide-area cooperation network for the development of spatial data infrastructure in West Africa and promotion of utilization of geospatial information data.

I would like to express my gratitude, on behalf of the Government of Japan, to the Minister of Infrastructure of Burkina Faso, the representative of UEMOA, the representatives of the national mapping organizations (NMOs) and officials concerned from organizations utilizing the data in West Africa for participating in the seminar.

I have long taken notice of the importance of geospatial information, or topographic maps. It is needless to say that geospatial information is information with positional information, information on elevation and information on place names correctly entered in it. It is a data infrastructure for national land development, or essential information for promoting wide-area infrastructure development and sustainable economic growth. In addition, its existence is indispensable in our daily life as a data infrastructure for our social life including education, environmental protection, disaster management, tourism and recreational activities.

I, personally, often make inspection tours to various places. Topographic maps are very useful to me when making such tours. Before making one of such tours, I use a topographic map to locate the area where I am going to visit and, then, obtain information of the area including topography, vegetation, roads, railroads, rivers and shapes of city areas. I use the obtained information to deduce the lives and culture of the local people.

Now, I would like to express my opinion on the necessity of the Technical Seminar for Wide-Area Collaboration about Geospatial Information.
I was informed that a common understanding had been established in the previous seminar held in December 2012.
The common understanding is "Since the problems faced by each of the national mapping organizations in the countries in West Africa are problems shared in the entire West Africa, a "sustainable cooperation network" will have to be created for the purpose of sharing solutions to those problems." Since creation of such a network requires more practical activities, it is important to hold a wide-area seminar to provide an opportunity for representatives of all the stakeholder organizations to meet together and share information and exchanges views on such practical activities.
Human resource development and strengthening of organizational capacity are examples of issues to be addressed by all the organizations. I hope that this seminar which is intended for sharing solutions to the issues will provide a very relevant and timely means for the solution to those problems.
In addition, insufficient publicity activities on the existence of developed geospatial information have been pointed out as an obstacle to the extension of its utilization. I have been informed that there will be presentations on the current state of the data utilization by user organizations in this seminar. I think that holding of a seminar like this one is also meaningful as it provides an opportunity to promote the data utilization through publicity activities.
At the Tokyo International Conference on African Development held in Yokohama, Japan, in December 2013, the Government of Japan renewed its commitment to the promotion of cooperation in the development of African countries. The Prime Minister, Mr. Abe, visited three African countries including Côte d'Ivoire last month, December 2013, and strengthened friendly relationships between those countries and Japan. These facts suggest that "responsible cooperation" of the Government of Japan in Africa, and in West Africa, in particular, is expected to be strengthened in future.

Finally, I wish that the efforts of the participants of the seminar and other stakeholders will lead to successful conclusion of this seminar and that outcome of the seminar will lead to further development of geospatial information in West Africa and its utilization as a tool to facilitate further social development in West Africa.
I wish further success in the work to IGB, members of the mapping project and the national mapping organizations, which have sent their representatives to the seminar, before concluding my speech.

Notes)

Reference:

★NMO: National Mapping Organization

National mapping organization where mapping includes surveying and creation of topographic maps

★Geo-spatial information: The Basic Act on the Advancement of Utilizing Geo-spatial Information went into effect in 2007. Geo-spatial information can be defined as follows.

(1) In a broad sense: Geo-spatial information consists of positional information and additional information (including elevation, place names, topography and vegetation) that all the objects on the ground surface have.

(2) In a narrow sense: In general, it includes topographic maps, aerial photographs and statistical data. It is frequently used in the GIS (geographic information system)

3.4.2 Contents of the presentations by the representatives of the participating countries at the UEMOA Seminar for Wide-Area Collaboration]

Photo 3-13 Presentation by the representative of a participating country at the UEMOA Seminar for Wide-Area Collaboration

1. "The Hunger Project in Benin"

Use of geographic data in the implementation of the epicenter strategy by the Hunger Project (THP) in Benin

- Why are topographic maps required?

  Topographic maps are required as a tool to request support of the National Geographic Society (a

national organization for the creation of standardized geographic data) to achieve further improvement in the hunger mapping in Benin, as an intervention tool to understand and control the activities and areas of activities of THP called "epicenters" to which THP intervenes and as a tool to facilitate improvement of the quality of the evaluation.

- How have topographic maps been used?

  IGN-Benin was involved in the following detailed mapping process:

  - ✓ Interpreting structured elements of dynamics of epicenters; and
  - ✓ Showing the density of intervention of THP-Benin in each village in each epicenter

- To do the above mentioned,

  Topographic maps created by IGN/THP-Benin which include hard-copies of the thematic layers, in order to do the following are collected:

  - ✓ Identification of relationships and trends from visualized data;
  - ✓ Implementation of spatial analysis; and
  - ✓ Improvement of the strategies for designing, planning, monitoring and evaluation

- Utilization of topographic maps

  THP used 1/50,000 topographic maps showing the entire areas of all the villages in which it intervened 1) to record impact of community infrastructure projects on villages and communities and 2) to measure the necessity for projects and to decide the areas for the application of programs.

- Advantages of using topographic maps

  - ✓ Observation of dynamics of activities at the village level for the achievement of MDGs and empowerment of epicenters
  - ✓ They provide many opportunities where several villages are presented and the levels of social infrastructure in those villages can be evaluated simultaneously. (It enables evaluation of the efficiency of extension methods.)
  - ✓ A reference tool for comparative measurements between various components in an area, including measurements at different time, in different social dynamics and at different levels of development
  - ✓ A tool to create partnership with local governments and other organizations because topographic maps are useful in highlighting the output and tangible outcome of activities implemented in society

2. "Usefulness of topographic mapping for the development of the Urban Master Plan in Greater Abidjan" - Côte d'Ivoire

I. Greater Abidjan Planning Scheme in progress

a. Circumstances surrounding the development of the master plan

- Rapid growth of the city
- Urban master plan approved in 2000
- Lack of comprehensive medium- and long-term development plan on paper
- Resumption of cooperation with Japan

b. Purpose of the study

The purpose of this study is to examine the master plan for Greater Abidjan from the viewpoint of sustainable development, using locally-available documents on land as reference.

c. Urban Plan

- Urban Plan
- Urban Transport Plan

d. Outline of the Urban Plan

d.1. Institutional strategies for the urban planning

- Scope of Greater Abidjan
- Plan for reasonable growth of Greater Abidjan
- Options for recommendations on use of space for harmonious urban development

d.2. Details of Urban plan

- Land use plan
- Actual measures to control urbanization

II. Conclusion

Topographic maps are extremely important in the development of master plans for urban planning. At present, JICA is creating topographic maps of the Greater Abidjan Area. One of the reasons for the importance is that the CCT/BNETD is responsibly managing the 31 districts which they control.

3. "Protected Areas in Guinea Bissau"

- IBAP (The Institute for Biodiversity and Protected Areas)

The following duties were assigned to IBAP on December 14, 2004

- Implementation, recommendation and coordination of the policies and activities on biodiversity and management of protected areas in Guinea Bissau
- Promotion of protection of eco-systems and biodiversity in inland areas and in the sea, socio-economically sustainable use of PAs and natural resources in the country and environmental protection

- Process to designate PAs

  IBAP adopted a discussion model with community participation in the process of designating PAs so that not only environmental but also socioeconomic factors should be considered when areas to be protected were to be designated.

- Protected Areas (PAs)

  After a few years of study, IBAP recommended establishment of four national parks, one archipelago biosphere reserve in the Bijagós Islands, forest reserves and a national system for traditional resource management and protected areas.

  In order to improve ecological sustainability, a project to establish new PAs with comparative analysis of candidate areas with the established parks is being implemented.

- National system concerning PAs of Guinea Bissau

  In order to fulfill its duties, IBAP uses downloaded Quantum GIS, software for the GPS-CatTraQ system and Garmin-MapSource in the data analysis and processing for linking the data obtained with the downloaded systems with topographic map data.

4. "Use of geospatial data by the Ministry of Forests and Environment" Guinea-Conakry

I. Collection of geographic data

Mosaics of satellite images and aerial photographs created by JICA (1977 – 1978)

- Digitization of existing topographic maps
- Conversion to GIS data

  Capturing of positional information with GPS receivers: villages, farming land, footpaths of domestic animals, roads for forest management, etc.

II. Forest inventory

Map creation work is conducted both in the office and in the field. Vegetation maps and land use maps can be created only from satellite imagery if the conditions on the ground of the areas covered by those maps have been known in detail. Data of the facilities selected to be included in the inventory shall be obtained not in the office but in the field using GPS receivers.

- In the office
  - Decision on creation of topographic maps for survey and mapping areas
  - Selection of locations of inventory plots with assistance from forest engineers
  - Marking the coordinates of plots obtained in the field on topographic maps

- In the field
  - Positional information of plots obtainable with GPS devices

- Capturing of positional information of areas appropriate for creating inventories and boundaries of such areas with GPS devices

III.Conclusion

An established forest inventory provides information on quantity and quality of natural resource in a forest. A comprehensive image of a forest can be visualized by overlaying contents of a forest inventory on a topographic map. Development planning maps which include information on needs of the people have been created in order to show how to protect forest resources. Creation of all these maps has been made possible with the use of geospatial data.

5. "Utilization and Creation of Geographic Data in West Africa" - Mali

This presentation was prepared for the following purposes:

- To understand how topographic maps are created and used in Mali;
- To identify problems and main challenges concerning topographic maps in the plan; and
- To offer recommendation for coordinated development of topographic mapping

Situation 1:

Creation of topographic map data infrastructure in Mali is the most important duty of IGM in Mali. Mostly older engineers are involved in the topographic mapping. IGM (Geographic Institute of Mali), INSTAT (National Institute of Statistics) and Carpol Cell (Cadaster Planning Services) are among the organizations creating topographic maps in Mali.

Situation 2:

Creators of thematic maps, such as engineers who are in charge of mapping in public and private sectors are working with research centers in the U.S., implementing agency dealing with registers in Ségou and GIZ with funds for topographic mapping with satellite images (including information such as topographic features, rivers, roads, etc.) at ICRINSTAT Niger Office based in Ségou.)

Situation 3:

IGM develops and publicizes geographic data and updates them for changes over years. In the cadastral survey, IGM verifies topographic map data and data of levees and land parcel boundaries. INSTAT implements national surveying, publicizes RGPH and creates topographic data which are used as background data in the preparation of RGPH.

Situation 4:

IGM supplies two types of data (topographic and thematic map data). Both of them are sold for maintenance and creation of data of both types. The base topographic maps of Mali (136 sheets of raster digital data) are revised versions of the maps created in 1960. IGM owns 1/25,000 digital thematic maps of roads on Bamako, the eight major cities and other satellite cities.

- Recommendations

I. Since the rapid increase in the creation of topographic maps and the variety of data storage may cause misplacement of topographic maps and inequality in their quality, topographic maps should be managed and supplied by IGM. For this reason, IGM should be given the status of a creator of topographic maps.

II. It seems necessary for the Statistics Services, the Ministry of Territorial Administration and Security and Ministry of Internal Security and Civil Protection to have national base maps, which are to be created by IGM, in order to satisfy basic needs for topographic map data of local authorities.

III. Improvement in the accuracy of geographic positional data of ground control points may strengthen the explanation of the outline of urban and rural areas and enhance recognition of the national boundaries.

IV. Productivity of IGM should be increased in order to support the process of defining the boundaries with neighboring countries and implementation and extension of the work required for the process. Only 2,500 km, or approx. 33 %, of the 7,575 km-long national boundary has been defined so far in Mali.

V. The existing 1/200,000 topographic base maps are not suitable for data utilization because they are raster GIS maps. Therefore, these maps have to be converted into vector data maps.

VI. In the short term, the city maps at the ordinary scales of 1/2,000 and 1/5,000 will be considered as substitutes for urban planning, which is only a draft created by combining existing subdivision plans at present.

VII. For the purpose of establishing detailed and elaborate plans with the base maps most frequently in the medium term effort for the improvement of mapping, the scale of 1/50,000 is the optimal scale for topographic mapping of the entire country.

6. "Creation of Geospatial Data and Their Use" – Niger

I. On urbanization

- Definition of an urban area

  Urban planning sometimes becomes a subject of a study on cities while it is being conducted, because such a study combines multiple sectors repeatedly and it is based on the concepts at different scales of space and time. Many experts (including planners, architects, engineers and lawyers) contribute to its formalization in the forms of definition and planning of projects, programs and technical documents.

- Many definitions

  Political, social, economic and legal definitions of human life are key to planning against all problems.

- Definitions of experts of different types

  Political scientists, sociologists, philosophers, architects, planners are among those who are considered as experts.

II. Cases of the use of map data

Map data are used in the national land development, urban plans and forest management. Management at the national level cannot be implemented without topographic maps at low and medium scales. These topographic maps can be used by planners and forest engineers in the UEMOA region to identify projects required generally in small areas, because the maps provide information on areas, sectors and distances between all cities.

III. Topographic maps and thematic maps

It is believed that topographic and thematic maps are required for better understanding of restricting and favorable factors for the development of national systems, regions and regional plans. For example, existence of many thematic maps, population distribution maps and vegetation maps created with topographic maps is widely recognized by the general public.

IV. Plane and elevation measurements

- On plane and elevation measurements

  Plane measurements provide information describing land, and elevation of land is expressed with contour lines. From a different viewpoint, there is a need to create large-scale topographic maps, *e.g.* ortho photos with contour lines and mosaics of aerial photographs (though they contain only plane data). The data mentioned below are collected and the use of the collected data is allowed to make recommendation on definition of surveys and analyze fields of development in accordance with types of relevant documents.

  - Floodplains
  - Operation of drainage and sewer systems
  - Risk of erosion and partitioning of site linked with alleviation of the risk
  - Private and public space and infrastructure and clearance for permission
  - Types of residential areas and land use
  - Vegetation maps and slope risk maps

- House map

  A house map is the outcome of the consolidation all data-processed layers. These data lead to establishment of a geographic information system for better management of urban areas.

7. "Creation and Use of Topographic Map Data for Production and Distribution of Drinking Water in Urban Areas in Senegal"

- Relationship with customers in production and distribution of water and charging and collection of water fees at a maximum of 56 urban sites and in more than 400 villages

- Management with geospatial information
  - Understanding
  - Planning and
  - Instantaneity

- Issues
  - Establishment of our technologies and system to satisfy the requirements (reliability and completeness) for appropriate management of geographic information of business clients

  - Consideration to major change related to the services on GIS platforms using enterprise applications and interfaces of others for better data sharing

  - Management of AEP network data to maximize our intervention and capacity to analyze the decision-making on topographic map information at a high level in controlling the management

- Purposes
  - Conversation as a form of integrated management
    - Involvement of IDG at all the work sites of the core projects
    - Central storage of data obtained from users and sharing of information for technical exchange for decision-making
  - Implementation of an established shared mechanism

- Recommendations to the UEMOA member countries and Guinea
  - Peer review and update of geospatial information under *ad hoc* sub-regional projects and boundaries of areas and restricted life under *ad hoc* contracts between two countries

  - Establishment of regional sub-committees for consultation and coordination

    The standard is to be created at the level of sub-region. Appropriate policies, tools, mechanisms and standards at the regional level are to be established.

  - Preparation of an action plan among the participating countries

    Under this action plan, an integrated management framework involving all stakeholders shall be implemented and sufficient and authoritative power shall be given to the framework.

  - Holding of conferences for information sharing among the peers

    Establishment of sub-regional platforms for data distribution

- Economic growth of a considerable scale facilitated through creation and utilization of geospatial information

8. "Contribution to Sustainable Flood Mapping by Local Governments in Lomé" – Togo

I. Introduction

Outline of Togo

Location:	It borders Burkina Faso, the Atlantic Ocean, Benin and Ghana in the north, south, east and west, respectively.
Area:	56,600 km^2
Population:	6,000,000
Capital:	Lomé

2. Urban problems

Togo has experienced rapid urbanization in the last 30 years and long-term social and political crisis. The urbanization of the capital, Lomé, and all the other urban areas is putting strong pressure on the land, society and community facilities. Therefore, the gravity of various environment-related problems including those of inadequate sanitation and waste management and noise is on the increase.

3. Problems in Lomé - floods, population growth and urban concentration

Since all these problems mentioned above are hygiene-related problems, they are a concern of the local governments in Lomé. Lomé was once called a 'beautiful' city. However, the city has been hit by floods every year in recent years.

Because of quite insufficient design structure of existing structures, the number of countermeasures which could be taken on those problems is limited. Therefore, population growth and urban concentration have facilitated stagnation and discharge of rainwater which could cause serious damage

To solve these problems, the Government of Togo received financial assistance from the World Bank and the Japan Fund for Global Environment and provided a US$ 270,000 loan to the Emergency Project for Rehabilitation of Infrastructure and Electric Services (PURISE) in Lomé in 2010. Rehabilitation of the drainage and sewer systems of the city is being implemented with this loan. As a measure against floods which occur every year during the rainy season, drain water from the city was discharged directly into the lagoon. In practice, gravity was used to drain off drain water in the elevated area in the north of the city into the lagoon at the ebb tide.

4. Conclusion

As mentioned above, it has been proven that an operational drainage system cannot be constructed without topographic map data. This project was a preparatory action for the construction of sanitary facilities in Lomé and the surrounding area which began in February with financial assistance from the World Bank.

9. UEMOA "Road Information System (CRS)"

I. Background

The Road Information System is a framework to function for the harmony with the national sector policy and for the transport infrastructure. It is also a system designed for the information aimed at defining 5 axial roads in principle and for performance indicators. In this system, the axial roads in 33 Communities are defined and some specific interventions are provided.

The existing conditions of the Road Information System are as follows:

- Tools for diversity management

  The 7 member countries (Benin, Burkina Faso, Côte d'Ivoire, Guinea-Bissau, Mali, Niger and Senegal) of the bank of WAEMU (West African Economic and Monetary Union = UEMOA: Union Economique et Monétaire Ouest Africaine) have installed road data in their Road Information Systems. Togo is the only country that has no computerized BDR (base data régionale = regional database).
- The 4 main types of software using +HDM are as follows:
  - Operation mode
  - Data collection: Manual and automatic
  - Number of roads: Manual and automatic
  - Book inspection data

II. Communities with Road Information System (RIS)

a. Purpose of Community RIS

Mission of RIS is to monitor the strategic and operational goals, the resource mobilization, road development and the performance obtained in road infrastructure projects in obtaining the assistance for the decision-making tools in the assessment of needs.

b. Regulatory Framework

- REGLEMENT 08/2009/CM/UEMOA

  Adoption of the statute law for the agreement for the road community network and its management with UEMOA
- DIRECTIVE NO. 11/2009/CM/UEMOA

  Standard strategy for road maintenance in the WAEMU member countries

III. Current Status of RIS

- Technical research
- Support to national government
- Studies with main business application providers
- Selection of application platforms

- License acquisition, software installation and setup, and training
- Regulation core base development system: Establishment of reference materials

a. Technical Guidance

The application platforms that are accessible via Internet are as follows:

- GIS application GeoMap
- Engine DBMS: Mapping server of SQL servers
- Hardware inventory and network status calculation document
- Geographic application data
- Specific application database: OPA, axle load, transportation

V. Conclusion

The WAEMU (West African Economic and Monetary Union = UEMOA) committee and the member countries can possess intelligent tools in the transportation sector, especially in the road infrastructure states by implementing the RIS. The RIS is also a tool to make the dialogs and exchange of opinions with technical and financial partners.

10.Division of Capacity Development, Information and Environmental Monitoring/National Council for Environment and Sustainable Development (CONEDD)

- Present Status

  The Division is coping with the underground dam construction work in the Project to Combat Desertification. It has concreted the strong relationship with IGB in the environmental monitoring work. It has the expectation for acquiring the map data (the latest) in the future.
- Relation with Maps

  The maps are used to select any appropriate project sites based on topographic features and planimetric features.

Examples of Use of Topographic Data

The national framework to control the development, management and distribution of all the information that IGB possesses is intended to promote the utilization of the topographic data. These examples of use of topographic data use a part of the driver structure of the PNGIM (Programme Nationale de Gestion de l'Information sur le Milieu) that is not used only by the ISS partners.

The PNGIM (National Program for Management of Information on Environment) is a concrete WAS (WebSphere Application Server) structure which was embodied as part of promotion, settlement and control of the information on production control and environment in accordance with the laws and regulations MET / MARA / MTPHU that were enacted by the related ministries and agencies on

November 2, 1993.

I. Utilization of IGB Topographic Data

The following two policies are adopted:

- Network member level: Regular use of IGB topographic data as the standard data for adoption of animation
- Development of thematic map products at the SP/CONEDD level

II. Information Layers Incorporated in LEIS

- For NTDB: Almost all layers (area, road, water power and topography)
- All associated items: Soil, occupied land topology, climate and socioeconomic items, etc.

III. Conclusion

The topographic map database is a high-quality asset for a state and the secular change correcting work by IGB is welcomed by each governmental agency. The topographic map database allows not only the management of environmental issues but also facilitates the data exchange through active PNG network.

11. INSTITUT DE L'ENVIRONNEMENT ET DE RECHERCHES AGRICOLES (INERA)
Institute for Environment and Agricultural Research

- Present Status

  This Research Institute is engaged in agricultural and environmental research (which is related to traditional cereals, gardening, rice, cotton, stock raising and forestry, and protection and improvement of natural forest resources)
- Relation with Topographic Maps

  Mainly, the topographic maps are used for the measures for selection of suitable farmland and forest protection (as thematic maps). In the future, it is expected to digitize the maps.
- Media Data Mapping for Topographic Concept and Development
- National Inventory for Lowland Protection
- Utilization of Topographic Data
- Development of GIS Database and Topographic Maps by Intervention of PDset/Oncho Area
- Development of Forest Inventory in Municipalities in Burkina Faso
- Conclusion

Topographic maps are indispensable for creation of topographic mapping information for development, even if satellite images can be used. The topographic data (including earth roads, locations and road infrastructure) will be updated on a regular basis to improve the integrity and consistency of the data at the national level (for example by MATDS). By acquiring new information, the National Digital Topographic Mapping Database (NTDB) can be improved in quality and quantity.

12.Institut Supérieur des Sciences de la Population (ISSP)

(Higher Institute of Science of Population within Ouagadougou University)

Contribution to Population Science and Educational Agencies

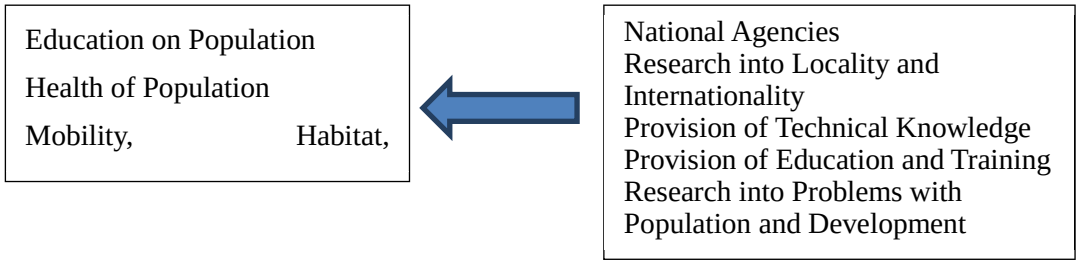

Fig. 3-2 Relationship Diagram of Research in Population Science

- Dual uses: Representation and change of detailed topographic map scale

  The map scale can be altered to change the field of vision. In human science, a small scale is essential to perceive the spatial separation of a social phenomenon. Therefore, the topographic map at a small scale gives a large potential for research and analysis. The evaluation of an actual physical phenomenon and its geographical space is tremendous and comprehensive. The necessary detailed information can be acquired by GPS, but it is impossible for the beginners, for whom the cooperation by IGB is required.

- Recommendations

  It is expected that IGB will provide renewed topographic maps. The topology mapping cannot always be made up. In other words, the topographic map with topographic elements cannot successfully be developed at any time. IGB should recognize that advancement and contribution can be made to the foundation of the place of exchange of technical knowledge in the GIS field and to vitalization of those activities as well as to the production of topographic maps. By so doing, it is considered that IGB will be able to be a good partner to other related agencies.

13.International Institute for Water and Environmental Engineering (2IE)

Examples of Use and Application of Topographic Maps in Topology 2IE

- Examples of use of topographic maps
  - ✓ Development of digital subterranean stream modeling (draft) at the experimental water use site Sanon for sustainable water supply to densely-populated areas
  - ✓ Training of 2IE staff using topographic mapping data
- Goals
  - ✓ Water supply stations for a local area can be secured.

- ✓ The coordinates of a location having a water problem can be defined.
- ✓ The basins can be drawn.
- ✓ The function of tracing the sectional topographic map is available.

- Methodology
  - ✓ Water tower layout plan on topographic map
  - ✓ Water distribution routing plan
  - ✓ GPS survey for solution to water problems
  - ✓ Reprinting of survey results on topographic maps

- Conclusion

  The data and topographic maps to be transmitted to hydrologists for modeling and water supply projects are indispensable tools to provide necessary support for the research into development projects.

- Remarks

  In general, the IGB topographic mapping data are used for thematic maps. In future, the necessity of digital and real-time data will increase. The Study Team thinks that it will be a good idea for IGB to develop the topographic maps which will be the firm base of thematic maps and to show off its existence.

14.Bureau of Mines and Geology of Burkina Faso (Bureau des Mines et de la Géologie du Burkina, BUMIGEB)

- Present Status

  BUMIGEB has produced 13 sheets of thematic maps by using the IGB 1/200,000-scale topographic maps.
  - ✓ The thematic maps indicate the accurate positions of boring points.
  - ✓ The sectional maps are produced based on the topographic maps and used for the geological analysis the surface layer of the ground.

Use of Topographic maps by BUMIGEB: Special case of producing 1/200,000 geological maps

1. Introduction

The geological survey for producing the 1/200,000 geological maps covering the entire national land is one of the tasks assigned to BUMIGEB. The geological survey was started in 1960 and made progress in several phases. In the first phase after the Independence of Burkina Faso, some sheets of geological maps were issued. In the second phase for the years from 1997 to 2003, an extensive project was implemented and 13 sheets of geological maps could be compiled with the cooperation of BRGM. The third phase started in 2004, is considered as very useful for completing the remaining geological maps in square degrees.

2. Importance of Topographic Maps before Fieldwork
   - Confirmation of access conditions to survey areas: Forests, water areas, in particular, concrete topographic features and areas with communications channel density.
   - Definition of the methodology for field surveys based on acquired topographic information

3. Use of Topographic Maps in the Field
   - Mainly roads and paths were used in the geological surveys using 1/200,000-scale topographic maps. The topographic maps were very useful to confirm positions and directions in the survey works.
   - Those maps were used for reference to the observation points on the ground, allowing the survey to be conducted in the 'minute' pitches.

4. Use of Geographic Data for Topographic Mapping
   - As a geological map is drawn on a topographic base map, all the necessary information including geological, land, geochemical and structural data is plotted.
   - The topographic information is displayed to avoid the overload due to the display of a topographic map, and the information and its quality is guaranteed prior to the display.
   - The geological maps are defined clearly and supported by adaptable topographical features as needed.

5. Conclusion

   It has been proved that the use and application of geographical data is indispensable for BUMIGEB to make geological surveys and produce mining geological maps. However, there are some problems with the method of using the geographical data as follows:
   - There are different projection systems for topographic maps between UTM/Adindan as used by BUMIGEB and UTM/WGS84 as the Study Team recommends.
   - Many of data had been acquired several ten years before and are different from the actual data in the present field.

This Project is welcome for us and the database and NTDB have been updated to provide the users with new and quality data.

3.4.3 Q&A in the Presentation on Geographic Institute of Burkina Faso (IGB)]

(Q&A in Session 1 on February 13)

Cote d'Ivoire →Burkina Faso

Q. Regarding access to IGB geographic information, it will be interesting for the UEMOA area

research offices to have access to digital information from the website, without having to go to Ouagadougou. For this purpose, are you allowing electronic payment and downloading of digital geographic information from your site?

A. IGB has decided to first install a system to allow access to its data with direct downloading of some of these. Users may identify their selected data, check the costs and make orders from the website. Delivery is still carried out manually. When possible for us, we will conduct electronic sales which will allow payment and access to data from your computer.

Electronic payment is a complex system requiring agreements with financial institutions and perfect mastery of the technology. We think that it will be more prudent to proceed more slowly and safely.

Benin UNDP → Burkina Faso

Q. What are the dates of the topographic maps being updated and with coverage at a scale of 1/50,000?

A. Maps being updated were edited in the 60s, based on aerial photographs from the 50s.

Maps with at a scale of 1/50,000 date back to the 80's.

Mali → Burkina Faso

Q. For the numbering of sheets, we recommend starting from the millions divided to the scale of 1/200,000. There is an international numbering adopted for this. For regional coverage, this numbering system must be used. How are the sheets named?

A. These sheets are divided according to the international standard. However, if a sheet only covers a small surface area of Burkina Faso, we will extend the sheet, to allow economy in printing.

For sheets which previously had the names of localities belonging to a neighboring country, new names were selected from localities in the sheet concerned. Generally, the name of the most important locality was selected..

Senegal→Burkina

Q. The procedure adopted by Burkina Faso complies with the rule which extends a sheet to include a small part of the territory in a map, or what is called an extension (crevé).

Under the ongoing project with JICA, what will be the coverage rate of the country for the map at a scale of 1/50,000?

A. The coverage rate will be from around 36% to 40% upon completion of this project.

Guinea → Burkina Faso

Q. How many sheets are being produced with JICA?

A. Forty sheets, with 36 for the north and 4 for Ouagadougou.

Niger → Burkina Faso

Q. How is the Commission of Toponymy structured and how does it function?

A. In Burkina Faso, a National Commission of Toponymy was created in the 80s for the revolutionary regime which made major changes in the names of certain areas. This includes the country which was renamed from Upper Volta (Haute-Volta) to Burkina Faso. However, it did not work out as planned.

The need to improve the quality of maps being produced has led Burkina Faso to create a new National Commission of Toponymy.

We selected two departments, one administrative (Ministry of Territorial Administration) and the other, technical (Ministry in charge of IGB). The chairmanship is assumed by the Ministry of Territorial Administration and IGB assures the secretariat. The secretariat is assisted by a toponymy office created under IGB to prepare documents to be submitted to the national toponymy commission. We were lucky to have technical assistance which enabled us to obtain the help of a UN expert with long experience in the National Commission of Toponymy of France.

3.4.4 Q&A on the presentation of the UEMOA

Senegal → UEMOA

Q. In the community town and its country planning department and infrastructures, are there themes other than roads which will be covered by the establishment of a geographic information system?

What was the data gathering process and what was the contribution of the different participants at the country level?

What was the result of the work carried out by UEMOA?

Togo → UEMOA

Q. You said that you have supported participants of the road information system in the countries. What does this support consist of? I also wish to inform you that Togo has finalized its complete mapping coverage at the scale of 1/50,000 through its cooperation with JICA. We are now studying the means to allow users to access it.

Cote d'Ivoire → UEMOA

Q. The reference system must be harmonized to avoid the overlapping of data. Is there a time chart for the signing of partnership agreements with geographic mapping institutions and the adaption of a reference system to establish the different themes on the same mapping base?

A. We are already using the topographic map at the scale of 1/20,000 as a reference map, but it is outdated and unadapted.

Niger → UEMOA

I am worried about the UEMOA procedure. UEMOA called us to a meeting in Dakar in 2010 to discuss the observation project for the community planning. Maps were provided to define the reference system for the integration of data gathered in the member countries. A study for the adoption of a reference for UEMOA was again presented and exchanges were fruitful, but while listening to the presentation, it seemed like the results of the study were not yet provided.

Mali → UEMOA

Q. What are the criteria used to determine community main roads in relation to the national roads? An overloaded map is less legible. Are you including all the sectors in a reference?

The total length of national roads in South Africa is 100,000 km.

In Algeria, it is 90,000 km.

The UEMOA area only covers 1,000 km.

What is the possibility of extending the main community roads?

A. UEMOA will introduce a server to hold the minimum shared mapping support. The UEMOA internet was installed in 2013 to improve the work. The rest may be studied based on themes, means and centers of interest. UEMOA will work to assure that the community system is compatible with national systems. Since it cannot conduct an inventory every year in the countries, it is the member countries themselves who must do so. We think that in two years, the system will be perfectly operational in the internet. It will allow all users to check ongoing infrastructure projects, including congestion problems in the main roads and the volume of traffic in the different corridors.

We have a time chart based on financing agreements. In the beginning of March, a financing agreement will be signed between UEMOA and the EU. We exchanged data with CEDAO and the question is how to jointly develop the process. Road classification began in 2001 and will end before the end of 2014. We need the corridors to boost integration. International roads will connect a national capital with different ports, and will connect the countries with each other. Since 2010, we are in the process of extending community networks. Accessibility is not a problem. For the road information system, we equipped the member countries with computer hardware in order to allow an exchange of data with the commission. Once the software program is considered acceptable after the information test in Burkina Faso, we will extend it to all these member countries. UEMOA may integrate thematic data of all sectors in its database. We therefore need the cooperation of all mapping institutions to build a geographic information system. We suffered a delay due to the retirement of an expert in charge of the project, but his successor has been recruited to make up for lost time and to assure progress of the operation

Comments of moderator (DGIGB)

We recently demonstrated the need to work together in collaboration with UEMOA which may significantly enhance our objectives.

3.4.5 Q & Users of Geographic Information

UNDP Benin to CONEDD

Q. Why will you not make IGB thematic maps in spite of their known usefulness?
Is IGB using thematic mapping data to enrich its basic maps?

CONEDD

A. There are around forty units using the geographic information. IGB is mainly in charge of the work assigned by the government under its mission to produce geographic information. I think that it will be difficult for IGB to take charge of themes outside its heavy task of basic topographic mapping. However, the thematic maps should use the same database. If needed for thematic mapping, IGB may contribute with its knowhow and mastery of the information systems.

BUMIGEB

A. It will be appropriate if the competent units can establish their themes according to their center of interest, since IGB will not be able to interpret specific data as geological layers and granite layers

2IE

A. The guidelines have assigned IGB with the basic topographic mapping responsibility. Users will establish their thematic maps based on geographic data produced by IGB

Niger (comment)

We have exceeded the quality level of Google Earth since GPS is easy to use and indispensable for field work.

DG/IGB

A. Since the Google Earth images do not have the required geometric quality, they can be used only for purposes of display. Geographic institutes must never use the Google images to produce maps without assuring their geometric quality, since the satellite camera is not stable in its orbit. This instability of the vector has led to distortions in the aerial photos or images which must be corrected, but Google does not always do this.

Basic topographic mapping is under the responsibility of IGB. It requires high qualifications and financial means. Different thematic sectors are aware of the importance of basic mapping. Together through different forums, we must convince the policy makers to invest in the high

objectives of development participants to create basic topographic maps for their program planning.

Production must comply with rules in order to enrich topographic mapping. Our geographic institutions must emphasize the importance of topographic mapping to our political decision makers.

UNDP Benin INERA

Q. What is the scope of the inland valleys in Burkina Faso? What is the scale limit to identify and closely investigate the inland valleys of a small surface area?

A. The inland valley consortium was established for the development of inland valleys for rural inhabitants. It organized a workshop to define the inland valleys in 1995. Criteria selected were considered during photo-interpretation. The width of the inland valleys in Burkina Faso is 20 to 55m and zones exceeding this dimension are defined as alluvial plains. Aerial photographs at a scale of 1/50,000 were used for stereo photo-interpretation. Topographic data at a scale of 1/200,000 were enlarged by 1/50,000 for areas where information at a scale of 1/50,000 was not available. After interpretation, verification in the field was conducted.

S.E.M Ambassador of Japan

I would like to extend my heartfelt thanks to DGIGB and all representatives of national mapping institutions and units of geographic information in nine countries.

Personally, I often travel and use the topographic maps produced by your institutions. It allows me not only to locate my destination, but also to have information on the relief, vegetation, roads, railways, rivers, as well as the life and culture of the inhabitants of the region concerned. It is therefore very practical in all fields. While listening to your interventions, I realized that the topographic map is related to our everyday life: agriculture, education, the environment, disaster prevention, tourism, transport, which essentially rely on the availability of geospatial information. On behalf of the Japanese government, I would like to convey the determination of Japan to assist in the effort of the authorities of the African countries, and especially in Western Africa.

3.4.6 Q&A Presentation of countries participating in Seminar.

Burkina→Guinea

Q. What is the topographic mapping situation in Guinea?

A. Topographic maps at scale of 1/50,000 (1/3 of the territory) and at a scale of 1/200,000 were produced during the colonization period (1940 – 1960). We have mapping data updated in 1982 through the Japanese cooperation program. Since a year ago, the mapping project at a scale of 1/50,000 is ongoing within the framework of Japanese cooperation program..

Burkina → Guinea Bissau

Q. We have protected forests in southwest of Burkina Faso. Do you have a problem of anarchic occupation of forests protected by the population?

A. Protected forests are found in the islands or in mangrove parks. The forest management committee monitors and protects biodiversity. Since the population residing in protected areas respect the rules for the protection of natural resources, we have no management problem. Last year, a JICA Study Team arrived in Guinea-Bissau, but due to the political situation, Japanese cooperation has not progressed since then. We are now greatly relying on the Japanese cooperation program..

Senegal → Burkina

Q. We congratulate you on the provision of better geospatial information as a result of the JICA topographic mapping project at a scale of 1/50,000.

Do you have a strategy for enhancing digital data for sub-regional development? Is there a copyright problem?

IGB

A. The government has approved the topographic mapping at a scale of 1/50,000 throughout the country as a priority in the mapping guideline system. However, it has no financial means for mapping and must look for support from its development partners such as JICA. IGB is actively working to increase public awareness on the importance of geographic information through the media or the IGB Open Door (planned for April, 3 days a week) and to explain the use of the information.

Last year, the prime minister visited IGB to learn the mapping process. Maps are on sale in IGB at a low price, only to cover minimal costs. The project plans the creation of a website to provide users with access to data and to make orders without the need to go to IGB. If our products are not available, they will be of no use for the users.

Senegal →Mali

Q. What do you mean when you say that the basic topographic map at a scale of 1/200,000 can be used for decentralization?

A. There are two types of basic topographic maps. The basic map used for decentralization is different from the basic topographic map covering the entire country. For example, we had a food crisis in 2004. To analyze this situation, the establishment of the information management center was considered, but due to the reticence of some institutions, the idea did not bear fruit. Given the necessity of publicizing data on the website, we are working in this direction. At present however, we do not have enough data..

Senegal →Niger

Q. Are addressing data used for other products derived from GIS?

A. Information on Niamey City (habitat, trade, roads, width/length of roads) was collected and the database is already established.

Benin (comment)

Most participants presented sectoral themes such as mines, forests, flooding, but they did not present a global vision. To plan for national development, it is possible to produce a theme on the different basic domains in the basic topographic map. Will it be necessary to relate the use of the topographic map and the follow up and evaluation mechanism regarding the development policy to evaluate the evolution of the situation? We must make several recommendations at the end of the seminar, and must have recourse to mapping organizations for the production of sectoral thematic maps (upstream and downstream).

Benin → UEMOA

Basic data produced by mapping organizations are used in the different domains. Since the geographic data currently available to us were produced before our independence, it will be necessary to update and standardize these data. We are asking UEMOA to establish unified standards.

Presentation of M.TAKANO

a. Training of personnel

In the field of geospatial information, the personnel must be trained to acquire new technologies to manage information. In order to do this, I recommend the following points:

- Active participation in training given by ING in Japan
- Technology transfer through experts from advanced countries
- Exchange of personnel in the sub-regional area
- Appropriate treatment of personnel according to their technical level to prevent the departure or the brain drain of personnel who have received training (in Japan, France, the Netherlands)
- Establishment of the GIS and mapping training center for UEMOA member countries and Guinea, and the organization of third country training in this center.

b. Reinforcement of organizational skills

The reinforcement of organizational skills constitutes the basis of all activities. It is important to establish a long-term vision on the management of national basic maps. Activities will be conducted based on the objectives.

I propose the following points.

- To establish a long-term plan with a long duration perspective

- To provide the budget and personnel required for the long-term program
- To redeploy NMO and clarify the distribution of tasks to be accomplished
- To reform the work environment through the assignment of appropriate personnel to raise work morale and encourage research in new technologies
- To promote publicity for use of the GIS and topographic mapping data
    - To obtain the support of people
    - To obtain a budget

3.4.7 Discussion

DGIGB

Personnel skills must be reinforced and trainees must remain in our organization instead of looking for more lucrative work in other areas such as the mining sector.

The Ministry of Infrastructures is presently studying a policy to prevent the flight of personnel to other sectors. This problem is a common challenge throughout our country. Based on the specific features of each country, we must draw up an appropriate collaborative approach to remedy this situation.

Mali

Mali started the digital topographic mapping project since 1996. Among the 6 trainees, there are only 2 who remained after the training program. Under the mapping project at a scale of 1/50,000 (48 sheets), JICA provided technology transfer but the mapping service was not included. As an example, it would be ideal to require the trainee to remain in the organization for 5 years after the training program.

UNDP Benin

All development sectors are confronted with the problem of the flight of personnel from one sector to another. It is to be expected that the personnel will always look for better working conditions. Therefore, it will be important to establish an incentive system such as career planning for the personnel. At the same time, a manual of technical procedures must be drawn up. In China, they say that the correct tool is required to carry out good work. UNDP is emphasizing the evaluation of personnel skills to understand the level of competence required at each stage.

Guinea

We have difficulties to understand the policy makers on the importance of topographic mapping, as the Department of Public Works is the supervision of the Geographic Institute of Guinea is subject to an assessment of their performance on the state of road development. Policymakers do not see it as the role played by the Institute.

DG/IGB

Geographic information covers various fields. Should the Ministry in charge of the geographic institute be a sectional Ministry, such as the Ministry of the Economy and Development, or should it be it be the Prime Minister's Office? However, this matter is for the government to study, and not IGB.

2iE

To reinforce personnel skills, career planning is important. A seminar, short training or a degree

course may provide good incentives for the personnel. 2iE has been giving a degree course since 2012. About thirty people were trained in 2013, but in 2014, there were no trainees due to the absence of financial means. We are therefore asking for JICA support. We have organized training on the geospatial system in collaboration with IGB between 1997 and 1998. We are also providing training on remote detection in Bacs+2.

GIS / UNDP Benin

Aside from reinforcing the skills of personnel and organizations, we must have a systemic vision, since the mapping sector is constantly evolving. There will always be persons who will lead the sector after their training, irrespective of the incentive measures provided, and new personnel will arrive from other sectors. We must therefore consider the diversification of personnel.

Senegal

The national mapping organization is under the national agency for country planning, which was created in 2009 to manage various fields. It was successful in retaining its personnel.

The Mapping Project in Western Senegal includes technology transfer, with a short training program conducted by Japanese experts. It proved to be very useful, but mastery of technical knowhow requires a longer training period. We wish to consolidate our knowledge obtained through the long history of cooperation between Japan and Senegal. We therefore submitted a request to Japan for the 2nd phase of the project.

Guinea Bissau

The problem is to keep personnel in all organizations. To resolve this matter, it will be necessary to establish a contract system to retain personnel for five or six years after their training.

DG/IGB

Accounting has no problem qualified personnel, but the mapping area is not the case.

Each representative shall submit to JICA for its return, a query on the capacity building of staff

M.TAKANO

This seminar was a good opportunity for JICA to exchange viewpoints with the participants.

It also allowed you to exchange your opinions with the Japanese expert. JICA wishes to promote sub-regional cooperation through UEMOA, at the same time as bilateral cooperation. I will report your resolution to the JICA Headquarters.

Mali → JICA

Does the project on five corridors in Africa discussed during TICAD cover North Africa and other sub-Saharan countries?

A. The project has not yet materialized. (JICA)

Guinea

In the speech of his Excellency, the Ambassador Plenipotentiary of Japan, he mentioned the determination of the Japanese government to provide support to African countries declared during TICAD.

Does this support cover the geographic information field?

A. Cooperation in this area is being studied.

As UEMOA has spoken, it is a good opportunity to link the proposed corridors in West Africa with the development of geographic information that projects are closely linked. (JICA)

Closing speech of Mr.TAKANO

It is a great pleasure for JICA, implementation of bilateral cooperation to be able to meet the member countries of the WAEMU and Guinea to the seminar organization. Personally, I loaded up this topographic mapping projects in Burkina Faso, Guinea, Ivory Coast and Mali. JICA will continue its bilateral cooperation. This sub-regional seminar was a new test for JICA. This is thanks to the strong leadership of DGIGB the seminar was successful.

The signing of the resolution on common issues (strengthening organizational capacity, staff exchange, awareness of policy makers on the importance of geographic information) is of significant importance. JICA wants to continue its support as your special partner.

3.4.8 Resolution of UEMOA Technical Seminar for Wide-Area Collaboration

The UEMOA Technical Seminar for Wide-Area Collaboration adopted the following resolution on the development, and use and application of the geographic information by all the participant countries before its closing:

Resolution of
the Seminar on Development, Use and Application of Geographic Information by the UEMOA Member Countries and Guinea

On February 13 and 14, 2014 at Ouagadougou

- *In considering that geographic information is an indispensable media for planning, monitoring and assessing national policies, programs and projects;*
- *in consideration of the increasing necessity of having geographic information as a tool to contribute to decision making;*
- *in consideration of the necessity of using the standardized model system, especially for development of the regional database;*
- *in considering that the responsible national agencies for geographic information development in the UEMOA region and Guinea are facing various difficulties in performing their services;*
- *in considering that the responsible national agencies for geographic information development committed to network making under the resolution as of December 2012;*
- *in the consideration of the necessity of producing the synergy effects among the national agencies that approved the network concept for building up the capacity of each agency; and*
- *in consideration of the political intention to support the African economic and social development that Japan declared in the Yokohama Action Plan in TICAD-V,*

we, the delegates of the agencies for developing and using map data in the member states gathered at the seminar held on February 13 and 14 in Ouagadougou and made the following commitments:

1. *To endeavor to strengthen our organizations and build up their practical capacity.*
2. *To exchange information on the technology in digital data development.*
3. *To promote the exchange of human resources among our national agencies.*
4. *To enlighten the policy decision makers of each of our countries on the necessity of giving the higher priority to geographic data development.*

In addition, we petition the following:

1. *We request Japan for its cooperation in offering its technical and financial assistance and relevant advice thereon for building the framework to build up the capacity of our human resources;*

2. *We request UEMOA for:*
   - *its support for making the network of the geographic data development agencies; and*
   - *promoting the geodetic infrastructure development and the creation of the standardized regional map models that has already been started.*

On February 14, 2014, in Ouagadougou

Signed by the delegates of the participant countries:

1. *The Republic of Benin*
2. *Burkina Faso*
3. *The Republic of Côte d'Ivoire*
4. *The Republic of Guinea*
5. *The Republic of Guinea-Bissau*
6. *The Republic of Mali*
7. *The Republic of Niger*
8. *The Republic of Senegal*
9. *The Republic of Togo*

3.4.9 Problems Common to the NMOs in West Africa and Solutions to the Problems

(1) Standardization of the specifications and accuracy

In West Africa, most of the geospatial information has been developed in the form of small- and medium-scale (1/25,000 – 1/200,000) maps. However, the specifications including map format and symbols and accuracy of those maps differ among the countries in the region. Geospatial information of standardized quality is essential for planning and implementation of projects for improvement and development of wide-area infrastructure. Solution to the problem concerning the map specifications and accuracy, which is required for the creation of topographic map data usable in the entire West Africa, requires creation of common specifications and standards for the data creation, "including standardization of geodetic reference system (coordinate system)," among the NMOs in the region. It is considered beneficial to have UEMOA collaboration seminars and workshops on a regular basis, as a venue to exchange views and have discussion on the creation of such specifications and standards.

(2) Promotion of development of organizational capacity and human resources

At present, there is a gap in the organizational and technical capacity and human resource development among the NMOs in West Africa partly because of the difference in the conditions including the state of economy among the countries. However, the establishment of a wide-area collaboration network as an output of the two seminars is expected to spread success at a point (in a country) to an area (multiple countries) and, thus, lead to balanced regional development. Human resource development expected to be achieved through the established network, in particular, is expected to lead to an increase in the number of trained engineers and adoption of

new technologies (transition from analog technologies to digital technologies) and, consequently, contribute to facilitation of technical exchange among the NMOs and creation of new employment opportunities in the region.

3.4.10 Conclusion of the Second UEMOA Technical Seminar for Wide-Area Collaboration

The table below shows the main areas where the utilization of the topographic map data is recommended and the necessity for the data in the areas presented as the conclusion of the seminar.

Table 3-4 Main areas of recommended utilization and the necessity of the topographic map data

Area	Reason for the need for topographic maps	Practical ways to utilize topographic map data	Outcome
Hunger Project	(1) To monitor the entire project (2) As a tool to control the project (3) As a tool to improve the quality of project evaluation	・1/50,000 topographic maps shall be used to determine target areas of projects to be implemented in villages and communities in need of community infrastructure (programs)	・The use of the data has been proven to be an effective tool for planning and implementation of plans by the administration as it enables evaluation of levels of social infrastructure development with simultaneous presentation of data of many villages and communities. It has also improved the quality of study and discussion on the plans.
Urban planning	(1) For land use planning which determines the general purposes of urban planning (2) For preparation and proposal of a master plan for coordinated urban development	(1) Creation of thematic maps (including land use, land cover, soil, vegetation and population distribution maps) for land use planning (2) In principle, so-called large-scale 1/2,000 to 1/5,000 map data are useful in urban planning. However, since such data have not been created and are expected to be created in future, the use of 1/50,000 topographic map data is the best option available at the moment. ・Measures against the urban sprawl ・Taxation measures (including tax collection methods) ・Promotion of reasonable planning for urban growth (development of airport, port and sports facilities, telecommunication systems and selection	・The data utilization is useful as a tool for the preparation of a master plan for urban planning and in the evaluation of the progress of urban development.

		of efficient traffic routes (bus routes and intersections) to be improved)	
Environmental measures Disaster reduction measures (with emphasis on measures against floods)	(1) To monitor forest reserves (2) To monitor wildlife and eco-systems (1) To acquire knowledge of local geography and topography (2) To locate villages and to know their population sizes	・ Acquisition of positional information of points for the monitoring of forest conservation and creation of biodiversity and carbon databases from the topographic map data to acquire comprehensive knowledge of forests Topographic map data are useful in learning how to conserve forest resource from the knowledge. (1) Acquisition of knowledge of shape of terrain (elevation, in particular) (at the scale of 1/25,000 – 1/200,000) (2) Acquisition of knowledge of courses and directions of flow of rivers (at the scale of 1/25,000 – 1/200,000)	Database construction i) Animal species found in forests ii) Distribution of trees iii) Locations of regenerating and idle land iv) Soil v) Sandbars, flat land available for development (1) Analysis of topographic map data enables simulations including that for damage estimation (2) Selection of evacuation routes and shelters
Agricultural development	(1) To acquire knowledge of local river systems (2) To assess the state of access roads (3) To find optimal soil	(1) Acquisition of geographic information (topography, elevation, vegetation, state of road development, rivers and their catchment areas, locations of irrigation facilities including reservoirs, locations of villages, precipitation, etc.) of land (areas) (at the scale of 1/25,000 – 1/200,000)	(1) Selection of crops appropriate for local soil (2) Establishment of transport and sales routes (3) Preparation of annual planting plans and establishment of a system for annual crop forecast (4) Development of effective irrigation facilities
Measures to extend educational and health services	(1) To support administration by the national and local government in education and health services on the ground (2) For efficient placement of schools and health facilities (including employment and assignment of teachers and doctors)	(1) Construction of a GIS with map data including statistical data relevant to environmental, population, health, food security problems at the global level (2) As a tool for implementation of administrative measures for urban and community development in the education and health sectors	(1) Better understanding of the current state causing various problems that the country has and an increase in the interest to participate in measures against those problems (2) Reduction of the gaps between different areas (villages)

Chapter 4 (22) Technology Transfer Work

The technology transfer was carried out as shown in the following figure. The details are as described in the main text.

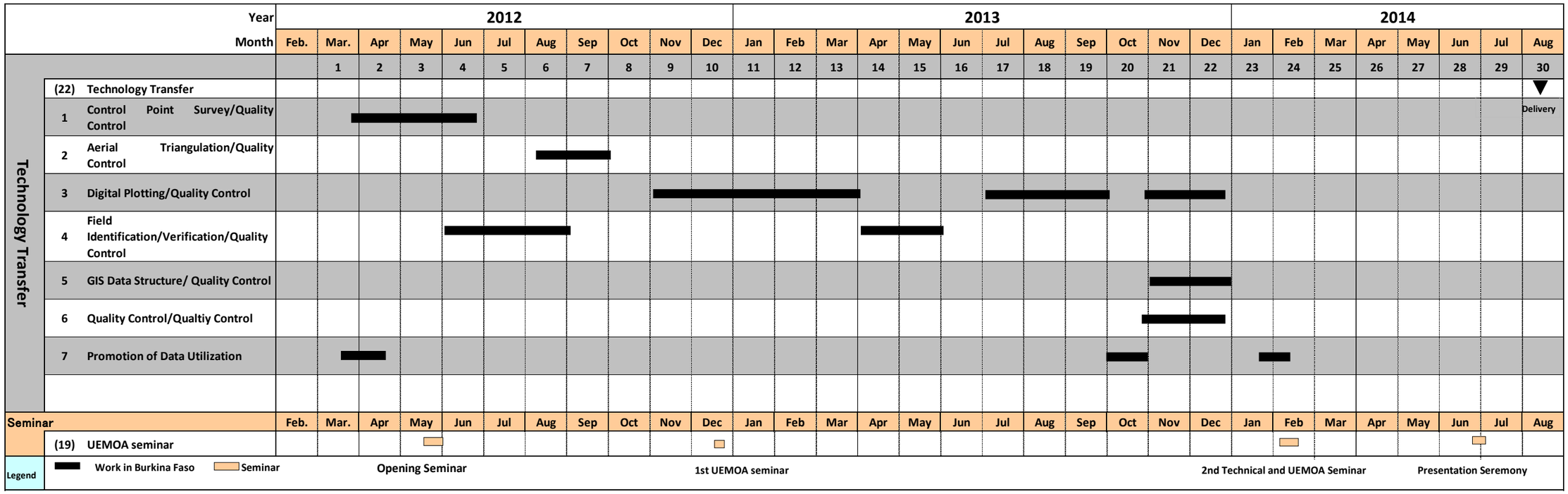

Figure 4-1 Technology transfer work

The technology transfer was carried out with the following objectives.

(1) To strengthen the capabilities of the Institut Géographique du Burkina (IGB) of Burkina Faso through the technology transfer so that they can develop and update maps themselves.

(2) That the digital topographic maps developed will be used as geospatial information to effectively further the national development plan.

The basis of the technology transfer was a review of past technology transfers, etc., as the background to the present technical capability of IGB, preparation of rules for map symbol specifications, etc., and topographic mapping.

The work associated with the technology transfer is summarized in the following table.

Table 4-1 Content of technology transfer work

No	Technology transfer work	Work content	Transfer method
①	Ground control point survey	・ Selection of ground control points ・ GPS observation ・ Pricking ・ Description sheet of Pricking point ・ Quality (accuracy) management	Learning work process through OJT
②	Aerial triangulation	・ Aerial triangulation of satellite images ・ Aerial triangulation for digital plotting and creation of orthophoto data ・ Quality (accuracy) management ・ Work manual preparation	Learning work process through OJT
③	Digital plotting / digital compilation	・ Reconfirmation of small scale topographic map symbols ・ Appropriate data classification of acquired data ・ Identification of unclear or problem areas ・ Input of collected data (administrative boundaries, names, road classification, etc.) ・ Quality (accuracy) management ・ Work manual preparation	Learning work process through OJT
④	Field identification / field verification	・ Interpretation key preparation ・ Survey and summary of unclear and problem areas	Learning work process through OJT
⑤	Digital Data structurization	・ Topographic data structurization ・ Preparation of basic data ・ Quality (accuracy) management ・ Work manual preparation	Learning work process through OJT
⑥	Map symbolization	・ Method of operating symbolization software ・ Preparation of data using map symbol specifications ・ Layer management ・ Quality (accuracy) management ・ Work manual preparation	Learning work process through OJT
⑦	Promotion of utilization/ construction of system of usage	・ Workshops/seminars for the promotion of utilization ・ Survey of existing organizations for the establishment of a system for data utilization ・ Awareness creation activities (lecture tours)	Learning work process through OJT
⑧	Construction of website	・ Understanding of the systems in use ・ Partial correction of data requiring updating and upload of the corrected data ・ Methods of map data management ・ System maintenance methods ・ Preparation of work manuals	Learning work process through OJT
⑨	Quality control	・ Provision of Overseas Mapping (National Base Map) Standard Specifications (English version) ・ Implementation of accuracy control in accordance with the	Learning work process through OJT

		Overseas Mapping (National Base Map) Standard Specifications	
⑩	Partial correction	・ Correction of existing topographic maps using satellite images ・ Preliminary interpretation of secular changes using satellite images ・ Correction for secular changes using orthophoto data	Learning work process through OJT

4.1 Details of the Technology Transfer Work

The details of the technology transfer work implemented are as follows.

4.1.1 (1) Ground Control Point Survey

The following points were implemented in the technology transfer through OJT of 4 IGB technicians. The IGB technicians that received the technology transfer on ground control point survey were as follows.

Mr. COULIBALY.R Mr. SOMANDE.B Mr. COMPAORE.S Mr. OUEDRAGO.B

Photo 4-1 IGB technicians participated in the technology transfer on ground control point survey

[Selection of ground control points]

Selection of ground control points was carried out referring to Google Earth and ALOS images, based on the ground control point arrangement scheme in the implementation plan.

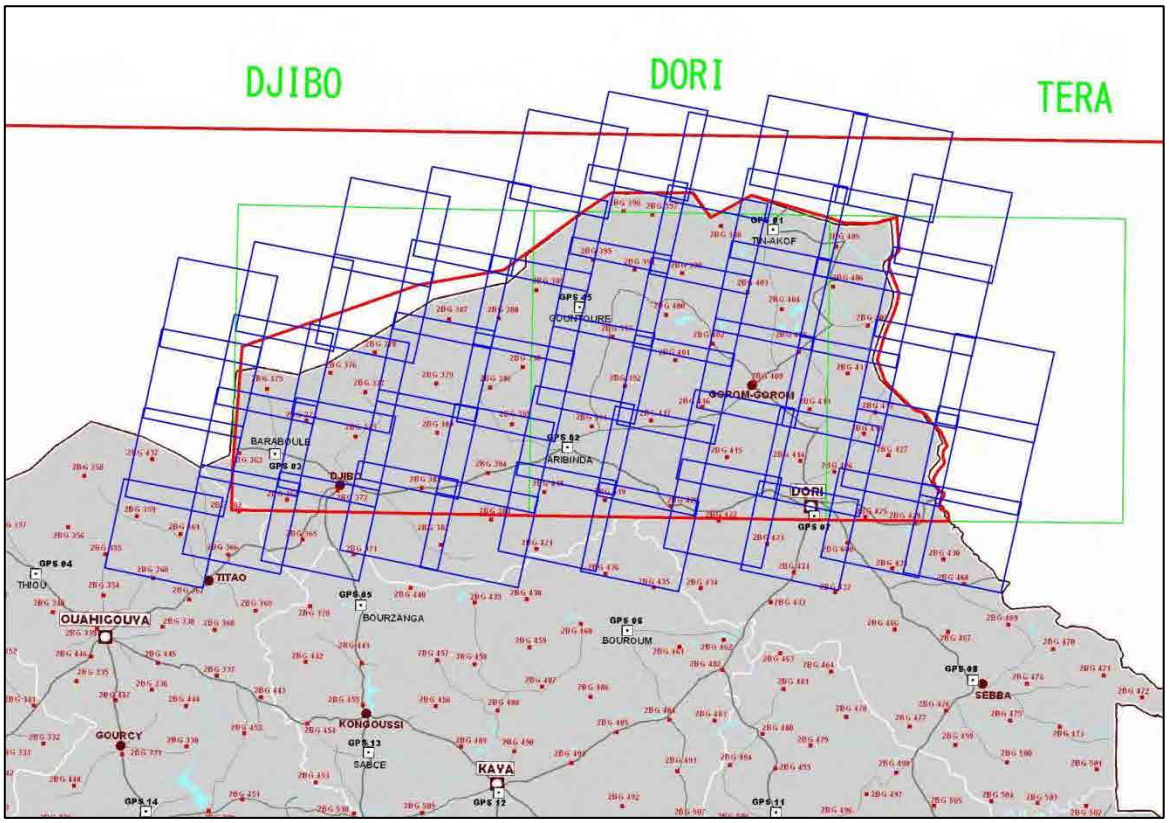

Figure 4-2 Control point arrangement scheme (North Block)

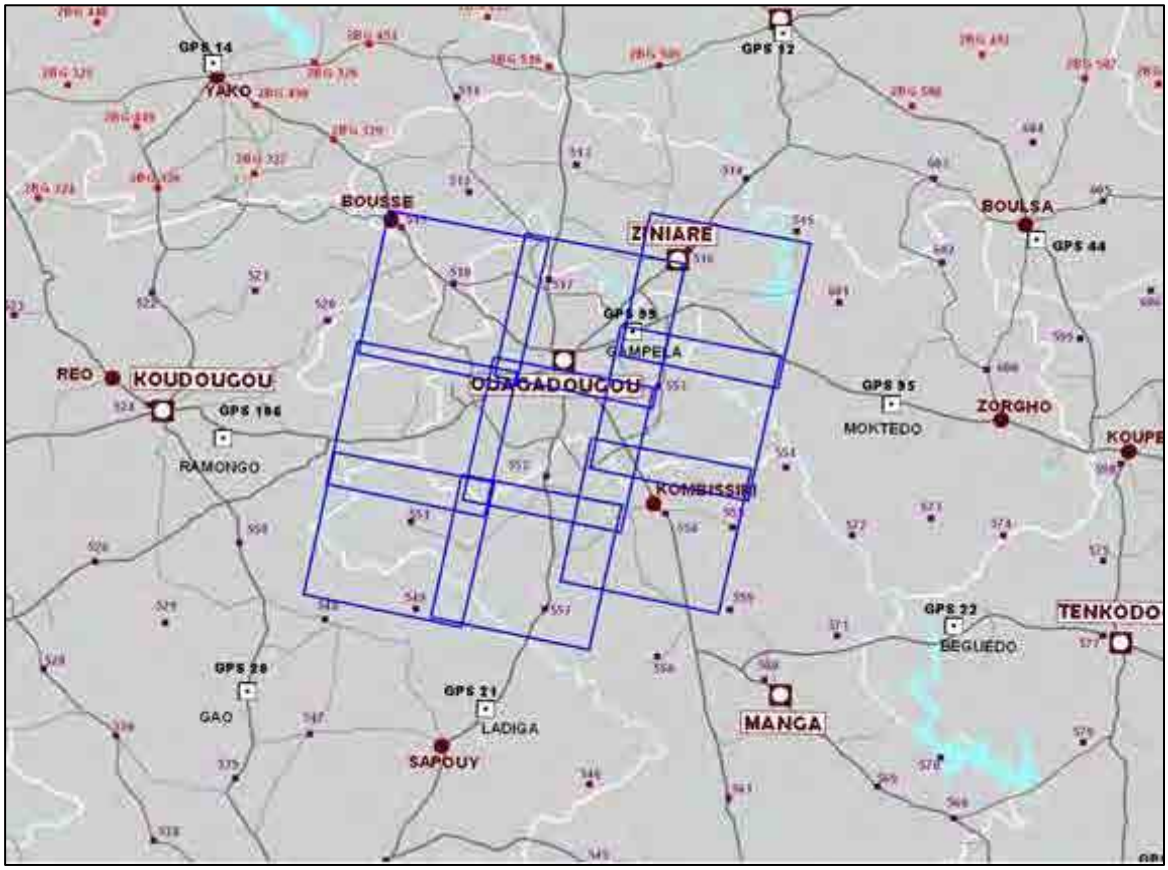

Figure 4-3 Control point arrangement scheme (Ouagadougou Block)

[GNSS measurements]

In previous technology transfer from the European Union (EU) for IGB technicians, GNSS receivers (Trimble R6-2) were used in control point survey, so it was not necessary to explain the measurement procedures and methods of using the antenna pole and carrying out functional inspections before measurements with the measurement equipment were carried out.

[Baseline analysis]

Data received from the GNSS receiver "Trimble R6-2" was converted into RINEX format. Downloading of measurement data and baseline data was carried out in accordance with the procedures manual of the training session that was implemented in association with the purchase of the LeicaLGO (Leica Geo Office) software.

[Network adjustment]

It was confirmed that the IGB technicians that received the Leica LGO training had not attained the level of being able to carry out network adjustments, so 3D network adjustment was carried out based on the procedures manual of the "LGO" network adjustment software, mainly by the Study Team.

[Simple leveling]

Inspection and verification was carried out by direct leveling the elevations of GCPs summarized from the EGM geoid model.

Photo 4-2 Instruction on leveling survey

Photo 4-3 Instruction on installing a barcode leveling staff

[Accuracy control]

Instruction was given on methods of accuracy control and process control based on Overseas Mapping (National Base Map) Standard Specifications.

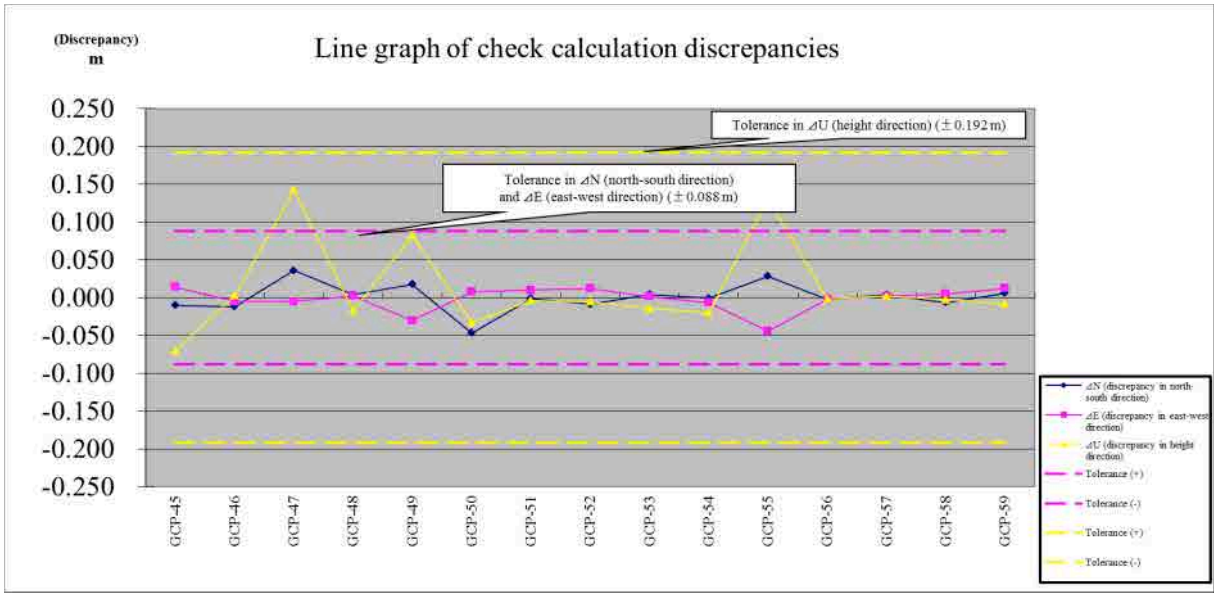

Figure 4-4 Check calculation discrepancy (Ouagadougou district)

[Summary of ground control point results]

From the 3D network adjustment results by GNSS survey, a "description sheet of ground control point" was prepared, and explanation and instruction was given on these operations. The IGB technicians

recognized the important data using the aerial triangulation, and it is expected that they will reach the level of being able to prepare the "description sheet of ground control point" on their own.

4.1.2 (2) Aerial Triangulation

The IGB technicians named below participated in the technology transfer on aerial triangulation.


Mr. KABORE Sylvain


Ms. SOUGUE Maimouna


Ms. KABORE Verigine


Mr. KONATE Aziz

Photo 4-4 IGB engineers participated in the technology transfer on aerial triangulation

[Objective]

The objective was to acquire the work processes and methods of operation of the software for aerial triangulation using ALOS/PRISM data with the RPC model which was used in this project. Also, instruction was also provided on the technology (pan-sharpening process) to create high resolution color images.

[Outline]

a) Period

- September 21 to October 12, 2012

b) Participants at course

Initially there were six participants on the course, but one dropped out so effectively the number was five, of which the number of technicians with work experience was three.

c) Software used

The software used in the technology transfer was as shown in the following table. In each case the software was provided by this project.

Table 4-2 Software used for aerial triangulation

Name of software	Purpose
LPS 2011 (by Intergraph Corporation)	Aerial triangulation
ERDAS IMAGINE 2011 (by Intergraph Corporation)	Pan sharpening process

* ERDAS IMAGINE is image processing software that is automatically installed when installing LPS, as the platform for LPS. In the latest version the LPS interface is integrated with IMAGINE.

[Contents of training and results]

a) Aerial triangulation

1) Preparation work

Explanations of ALOS satellite sensor information, scene IDs, RPC models, etc., were given. Also, the necessity and methods of changing scene IDs and the associated image creation methods, etc., were explained.

2) Creation of block files (various settings)

Technology transfer was carried out for the following preparatory operations which are necessary for implementing aerial triangulation with LPS. This operation is essential when a stereo plot or a DEM extraction or ortho is created with the RPC model only, without performing aerial triangulation.

[Tie point measurement]

This process requires most time in aerial triangulation, so much time was devoted to practical training. In the general operation flow, first tie points were automatically acquired using the software, and then acquisition omissions and acquisition error locations were checked and corrected interactively.

[Ground control point measurement]

The method of importing the 3D coordinate values of the ground control point measurement results and the technology of measuring the ground control points on the images using a detailed register was transferred.

a) Calculation processing and quality management

In order to readjust the RPC model, methods were transferred for carrying out aerial triangulation survey calculation (parameter setting method) using the RPC model, the ground control point and tie point coordinates, and ground control point results (3D coordinates), evaluating calculation results (intersection residual error, control point residual error), and based on the evaluation deleting the error points, re-measurement, and additional measurement.

b) Pan sharpening process

Using color images in topographic mapping is effective from the point of view of improving readability. The color information (RGB, etc.) of low-resolution color images is synthesized with high-resolution monochrome images to produce high-resolution color images known as pan sharpened images. This process is widely used in the remote sensing field using optical satellite images. In this project also pan sharpened images were used in digital plotting and production of ortho images. Therefore the technology of the pan sharpening process was transferred in this technology transfer.

4.1.3 (3) Field Identification / Field Verification

The IGB technicians named below participated in the technology transfer on field identification/verification.


Mr. NIKIEMA Sagadogo


Mr. KOUDOUGOU Sibiri


Ms. COULIBALY Safiatou


Mr. KONATE Aziz

Photo 4-5 IGB engineers participated in the technology transfer on field identification/verification

[Field identification / Field verification]

Technology transfer was carried out for field identification/field verification by OJT by carrying out the actual operations as described previously. Also, ground photographs and coordinates were obtained using a GPS camera for important buildings, planimetric features, etc., which helped to improve the interpretation accuracy during plotting.

i) Methods of obtaining ground photographs and coordinates to assist interpretation
ii) Understanding of map symbols and acquisition criteria
iii) Material collection

4.1.4 (4) Digital Plotting, Digital Compilation

4.1.4.1 Digital Plotting

The IGB technicians named below participated in the technology transfer on digital plotting.


Mr. NIKIEMA Sagadogo


Mr. KOUDOUGOU Sibiri


Ms. COULIBALY Safiatou


Mr. KONATE Aziz


Ms. SOUGUE Maimouna


Mr. OUEDRAOGO Stanislas


Ms. OUEBAKOURA K. Edith

Photo 4-6 IGB engineers participated in the technology transfer on digital plotting

[Objective]

The objective was to provide technical instruction through OJT for an understanding of the fundamental concepts of digital plotting, implementing digital plotting in accordance with map symbol specifications, methods of operating digital plotting software, and methods of accuracy control, so that IGB themselves can prepare 1/50,000 topographic maps using ALOS images, and that IGB themselves can complete 4 map sheets of the project area.

[Outline]

a) Period

- First : November 27 to December 22, 2012
- Second : August 15 to September 30, 2013

b) Participants

There were seven participants, of whom three had work experience. Two had experience in acquisition of contour data.

c) Equipment used

An Intergraph LPS2011 and Bentley MicroStation were the equipment provided for the technology transfer. Details of the software used are shown in the following graph.

Table 4-3 Software used for plotting

Software or module name	Application
LPS 2011 Core (by Intergraph Corporation)	Registering images and settings such as control point information, coordinate system information, etc.
LPS 2011 Stereo	Module for stereoscopic viewing
LPS 2011 PRO600	Digital plotting module (* it is essential that MicroStation be installed)
MicroStation V8i (by Bentley Systems, Inc.)	CAD software for digital plotting

[Method of implementation]

The participants had no experience of plotting work using LPS, and although 2 persons had experience of MicroStation, their experience was of an older version. Therefore, it was decided to first explain the various settings, files used, and documents before start of plotting, and thereafter to carry out the actual plotting work.

[Target areas]

The time for technology transfer was limited, so the target areas were chosen to be 3 surfaces in the north block for which IGB were responsible, without providing a practice area. The target areas are shown below.

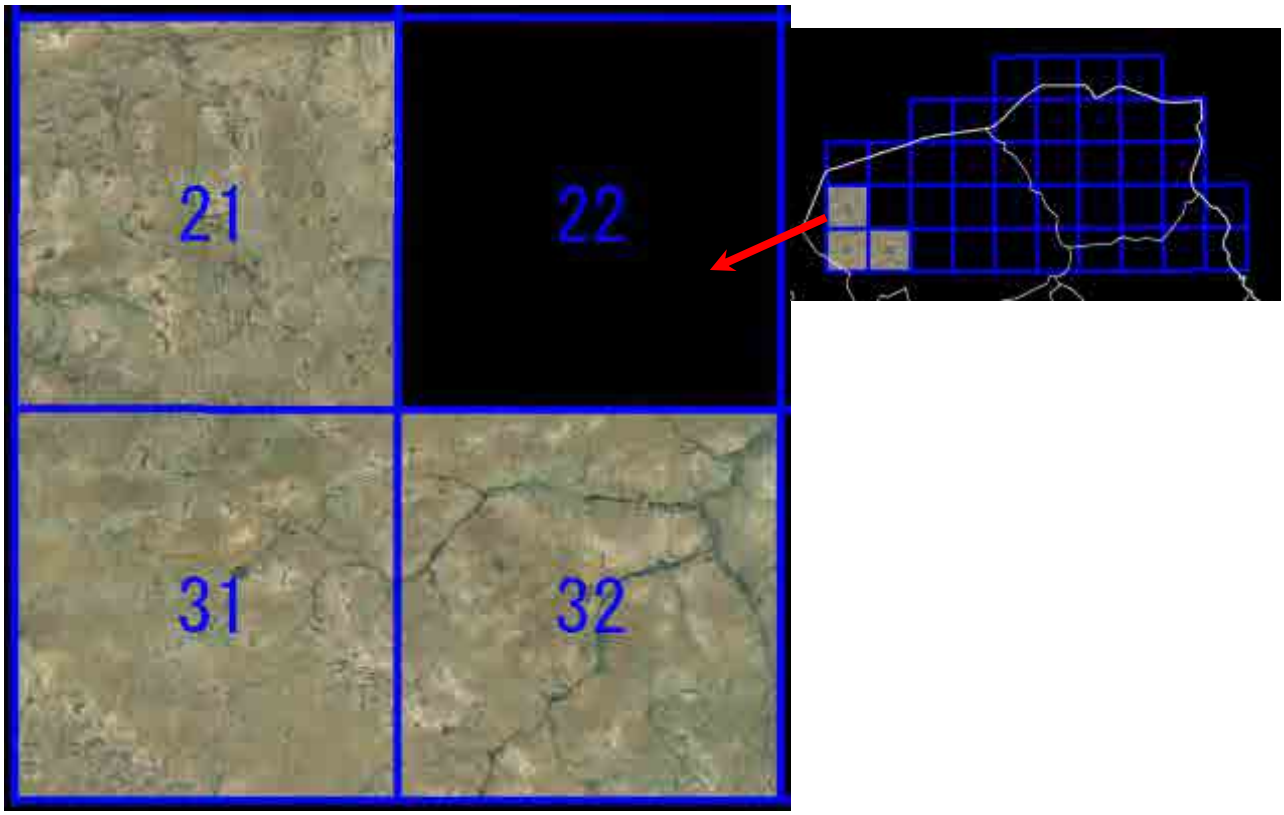

Figure 4-5 Target areas for technology transfer on digital plotting

[Implementation contents and results]

The following were implemented in the technology transfer on plotting:

1) Explanation of the outline of the digital plotting procedure;
2) Explanation of initial settings and basic operation of software used in the plotting, *i.e.* LSP and PRO600;
3) Explanation of operation of the data input device, TopoMouse;
4) Digital plotting of the study area;
5) Acquisition of contour data; and
6) Logical check and correction of the outputs with PRO600.

The figures below show the outputs created by trainees without assistance from the Study Team during and after the technology transfer. They had almost completed planimetric plotting of temporary sheets Nos. 31 and 32. However, as the field verification was in progress at this stage, not all the results of the verification were incorporated in the outputs. Newly-added map symbol items had not been incorporated in the outputs, either.

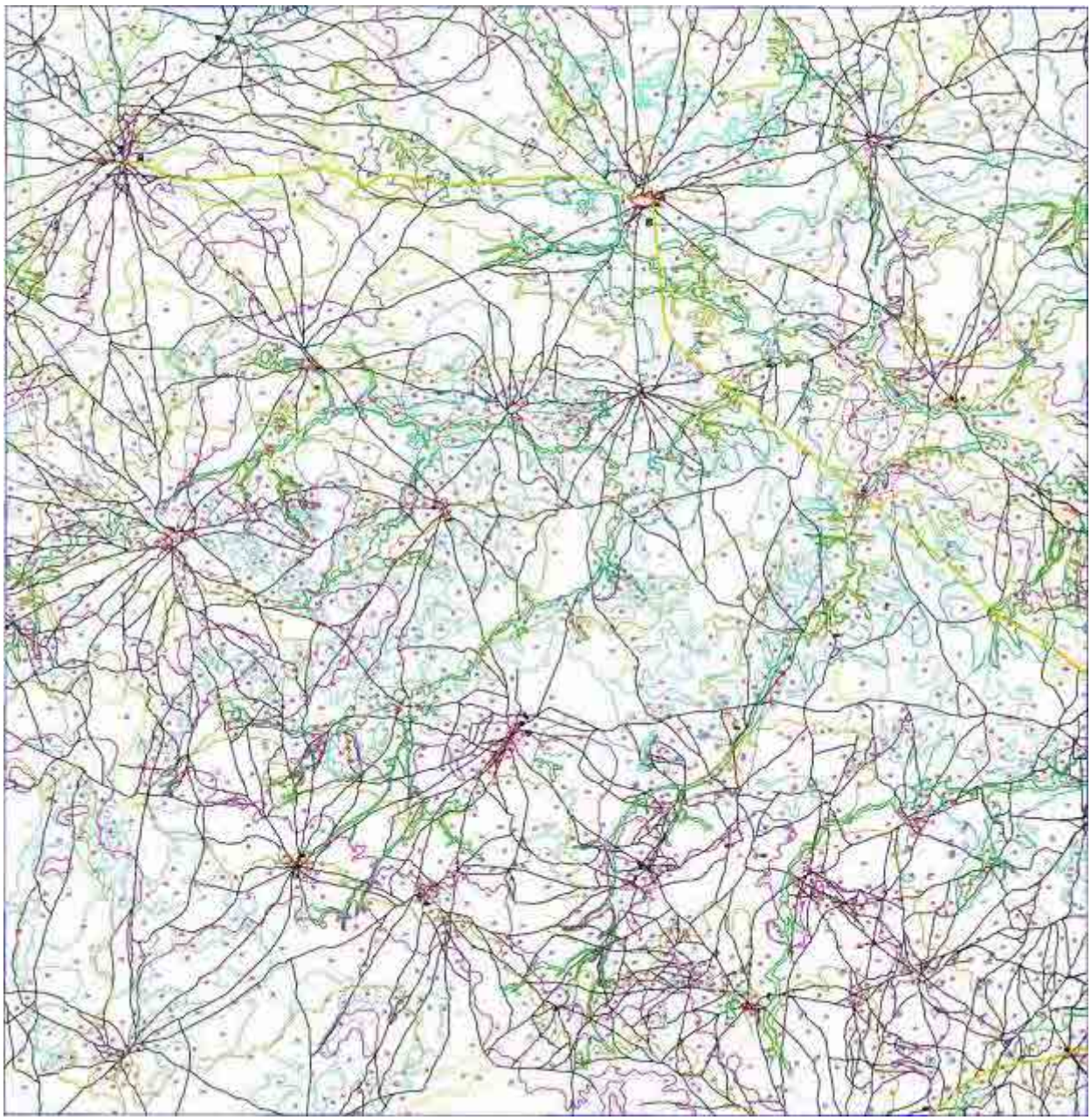

Figure 4-6 Digital plotting by IGB engineers (ND30XVII-1a)

4.1.4.2 Digital Compilation

The technology transfer on digital compilation at IGB began with the preparatory work implemented after the output data of the preceding stage of the digital plotting had been made available and before the implementation of actual digital compilation work began.

[Periods and trainees]

The technology transfer on digital compilation was implemented in two phases. The table below shows the period and number of participants in each phase.

Table 4-4 Periods and numbers of trainees in the technology transfer on digital compilation/digital compilation after field verification

No.	Implementation period	Number of trainees
Phase 1	August 6 – September 27, 2013	2
Phase 2	November 5 – December 16, 2013	2

[Equipment used (software)]

The pieces of software used in the Project mentioned below were used in the technology transfer.

- MicroStation V8i
- Bentley Map V8i

[Description of the technology transfer]

The Study Team decided to implement operation-oriented technology transfer consisting of repetitions of a series of lectures and practices on the five subjects mentioned below in order to ensure mastery of the technology by the trainees.

[Understanding of the 1/50,000 map symbol rules]

The instructor explained the map symbol rules for the 1/50,000 topographic maps being created in this project in detail to make the trainees understand feature items to be acquired, the acquisition standards and the data types. He also emphasized and explained to the trainees the importance of the issues in data acquisition and processing stipulated in the rules mentioned below.

[Technology for basic operation of the software in the digital compilation system used in the Project]

Since no one at IGB had experience in using the CAD software used in the Project, MicroStation V8i (hereinafter referred to as V8), the instructor provided technology transfer focused on basic user interface, tools and operation methods so that the trainees would understand them.

[Technology to configure an environment for the digital compilation in accordance with the map symbol rules]

In the beginning, the trainees used the symbols and line types, elements of an environment for digital compilation, to be used on output maps of topographic map data, prepared in accordance with the map symbol rules and provided by the Study Team. However, as they would have to implement digital compilation without outside assistance after the completion of the project, the instructor taught the trainees the procedure and method to create the symbols and line types adopted in the 1/50,000 topographic map symbol rules and the method to configure an environment with the procedure and the method in the technology transfer.

The instructor taught the trainees how to define the created symbols and line types and how to retrieve them in the technology transfer on environment configuration for V8.

[Basic operation required for the digital compilation]

Since no one in IGB had experience in working with V8 as mentioned above, and some of the trainees had no experience at all in digital compilation, the instructor taught the trainees the four subjects mentioned below in the technology transfer focused on operation and tools of V8 required for the work carried out in this project which was to be carried out by them in future:

- Tools in general;
- Shortcut functions;
- Creation of command files; and
- Creation/correction and inspection of topology.

[Quality control and data management]

The instructor taught the trainees a method of logical check of digital data with V8 and Bentley Map and a method of analog inspection of data output maps as quality control methods in the technology transfer.

[Results of the technology transfer]

The results of the implementation of the technology transfer on digital compilation were as follows:

- Understanding of the 1/50,000 map symbol rules

  The trainees tried to solve the problems of unclear features by changing layers arbitrarily. However, such arbitrary actions may have adverse effect on work in subsequent stages. The instructor told them that the map symbol rules had to be consulted at any time when cases of unclear features are handled and that observance of the rules was very important in such cases and urged them to recognize the importance of the rules.

- Technologies for basic operation of the software in the digital compilation system used in the project

  Although none of the trainees had experience in using V8, they managed to learn the basic operation of V8 without problem in the technology transfer because the instructor spent a significant amount of time on the training on the basic operation.

- Technologies to configure environment for the digital compilation in accordance with the map symbol rules

  The transfer of the technology to create map symbols had been completed with little problem partly because the trainees can actually see the created symbols. As the instructor expected that it would take a long time for the trainees to learn creation of line types because it required definition of a great variety of parameters, he used a strategy of beginning with creation of simple line types and proceeding gradually to more complex ones as a measure for smooth transfer of the technology.

- Basic operation required for the digital compilation
    - Tools in general
    - Shortcut functions
    - Creation of command files
    - Creation/correction and inspection of topology

[Quality control and data management]

- Data check

  A function to perform logical check of data automatically has been added to MicroStation V8. The instructor taught the trainees how to use the said function to check and correct data and the trainees learned it.

- Data output and visual inspection

  The trainees learned the methods to print out the topographic map data created in the digital compilation and inspect them visually by comparing the printouts with the photographs taken in the field identification in the technology transfer.

- Optimization of data file management

  Before the technology transfer, output data files of each process had been managed not centrally but personally by individual technicians who had created them. Therefore, the instructor urged the trainees to understand the necessity for centralized management of digital data and the risk of loss of personally managed data. He advised them to create a backup of each folder.

Photo 4-7 Practicing trainees

4.1.5 (5) GIS Data Structurization

The software used in this Project, ArcGIS 10.1, was used in the technology transfer on structurization of digital data. The trainees of IGB of this technology transfer had practical working experience with this software.

[Period and trainees]

Period : November 14 – December 20, 2013

Number of trainees : 1 (Mr. Konate was supposed to participate in this technology transfer. However, he was unable to attend most of it because he had to participate in the place name survey as it was an activity of higher priority.)

Ms. KABORE Verigine

M. KONATE Aziz

Photo 4-8 IGB engineers participated in the technology transfer on GIS data structurization

[Equipment used (software)]

One licensed copy of ArcGIS 10.1 of a U.S. company, Esri, used in the project was used in the technology transfer.

[Description of the technology transfer]

1. Practice of basic operation

In order to assess the level of mastery of ArcGIS by the trainees, the instructor in charge of data structurization of the Study Team asked them to practice the subjects mentioned below with sample map images of Ouagadougou district:

- Geometric correction of raster data (coordinate value data entry);
- Geometric correction of raster data (with MapToMap);
- Digitization (of point, line and polygon data);
- Addition of attribute data; and
- Creation of layout for printing maps.

2. Conversion of DXF files created in the digital compilation into Shape file format supported by ArcGIS

Two methods to convert data file format to the Shape format, one using ArcToolbox and the other using ArcCatalog, were taught in the technology transfer.

3. Data structurization

   The instructor explained the methods required in the structurization mentioned below and the trainees practiced the methods.

   - A method to correct topology with ArcToolBox;
   - A method to connect features which are disconnected at the edges of map sheets;
   - A method to add attribute to each feature; and
   - A method to subdivide data into defined feature classes

4. Definition of data projection methods

   The instructor explained a method to define data projection methods with ArcGIS and the trainees practiced the method. Since some of the projection methods used in this project were not supported by ArcGIS 10.1, the instructor instructed the trainees to practice only the methods to create projecting methods using the definitions of projection methods prepared by the Study Team.

5. Definition of symbols

   The instructor explained methods to define and create a map symbol of each feature with ArcMap and the trainees practiced the methods.

6. Creation of map layout

   The instructor explained the methods to display attributes as labels and to display all symbols of a certain feature in a certain orientation using printed 1/50,000 maps as teaching materials and the trainees practiced the methods.

7. Creation of data for WebGIS

   As the plan was to distribute data in a unit of map sheet with WebGIS, the instructor explained a method to divide data by map sheet and the trainees practiced the method. The instructor also explained that the same method can be used to divide data by administrative boundary.


Photo 4-9 Structurization of digital data

[Results of the technology transfer]

The technology transfer on GIS data structurization produced the following results:

- The trainees learned the method to correct images which had no positional information.
- They learned the technology to convert topographic map data in the DXF data file format into data in the Shape file format.
- They learned the technology to create GIS data from the topographic map data converted into the Shape file format including how to sort the converted data by feature class, construct topology with the sorted data and detect and correct errors in the constructed topology.
- They learned the technology to add attribute data by combining attribute data in MS Excel files with the topographic map data.
- They learned the technology to create map symbols with ArcGIS.
- They learned how to use data driven pages.
- They learned the technology to divide data to create data to be used in WebGIS.

4.1.6 (6) Map Symbolization

The goal of the technology transfer on map symbolization was to enable IGB to create data for printing 1/50,000-scale topographic maps without outside assistance. The output data of the digital compilation after field verification (in the DXF file format) were used in this technology transfer.

[Period and trainee]

Some of the details of the technology transfer on map symbolization were as follows:

- Implementation period :November 14 – December 24, 2013
- Number of trainees : 1(One)

Ms. SOUGUE Maimouna

Photo 4-10 IGB engineer participated in the technology transfer on map symbolization

[Equipment used (software)]

The graphic software used in this project, Adobe Illustrator CS6, was used in the technology transfer on map symbolization.

[Description of the technology transfer]

In order to implement the technology transfer efficiently in a limited time, output data of the digital compilation after field verification created in the Project (in the DXF format) were used in the technology transfer. The subjects of the technology transfer were as follows:

a. Lecture on printing environment

b. Basic operation of Adobe Illustrator CS6

c. Preparation for the map symbolization

d. Map symbolization

Photo 4-11 Technology transfer on map symbolization

[Results of the technology transfer]

a. Configuration of printing environment

The instructor explained the difference between printing film output and the conventional plotter (RGB) output and the significance of overprinting in preventing press misregistration to the counterpart, who managed to understand the overview of printing digital data with the explanation provided to her.

b. Basic operation of Adobe Illustrator CS6

The instructor explained the operation of Adobe Illustrator required for the map symbolization using the basic operation manual specifically designed for the map symbolization in this project and provided her with technology transfer in the form of problem-solving training. The counterpart had mastered almost all the operation.

c. Preparation for the map symbolization

- Definition of swatch colors

  Colors to be used in the map symbolization (swatch colors) were created in accordance with the map symbol rules.

- Creation of template file

  A file for the map compilation including the information on the stacking order of layers (map symbols) was created.

d. Map symbolization

- Changing the scale of DXF data
- Definition of stacking order of layers
- Conversion of objects in accordance with the map symbol rules
- Correction of inconsistencies
- Trimming of maps

e. Creation of topographic map data files for printing by combining topographic map data and marginal information data

The trainee learned the method to create topographic map files for printing by combining a basic marginal information file which included data of trim marks (called "*tombo*" in Japanese) and created topographic map data and replacing the information of map number, destinations and title in the technology transfer.

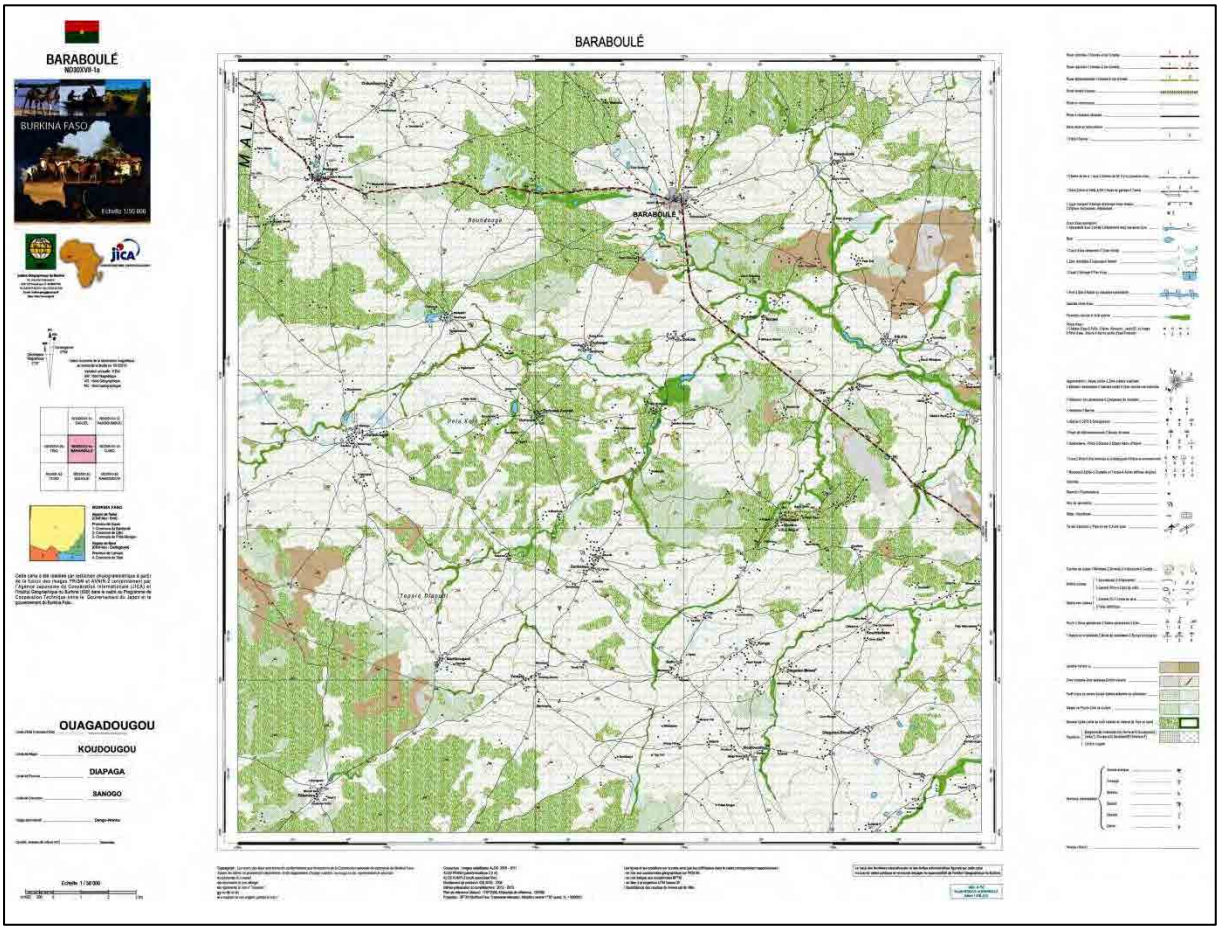

Figure 4-7 Final topographic map file for printing (ND30XII-1a)

4.2 Evaluation of Technology Transfer by Subject

1) Ground control point survey

Technology transfer for GNSS measurement, etc., for ground control point survey was carried out in the Ouagadougou district (Capital city district) in the form of OJT. In the Dori and Djibo districts (in the North-East), because of safety problems, instruction on process management and accuracy control was carried out at the residences in Dori City. It was confirmed that IGB were capable of implementing accuracy control themselves on site.

Because of a delay in submitting an "Application for Operation Permit" to obtain a government operation permit, and because the procurement of funds for operations did not proceed in accordance with plan, departure to site for site operation process control was delayed. It is expected that it will be utilized in upcoming process control.

The four IGB technicians had experience of control point survey by GNSS implemented by EU, so they had the skills for carrying out GNSS survey. However, only one technician had experience of ground control point survey, and the remaining three were inexperienced, so as a result of the effect of the OJT carried out in the Ouagadougou district, they were able to safely complete the GNSS survey in the Dori and Djibo districts within the schedule.

The methods of sorting and managing the GNSS survey documents were untidy, so instruction was provided on filing in A4 files, filing in time sequence, providing contents page, etc. It is considered that it takes a considerable amount of time before the IGB technicians became proficient at filing, sorting, and setting in order documents.

Through the work, the impression was received that the awareness of equipment management was low within IGB. The Study Team prepared an equipment management shelf, and provided instruction on methods of sorting and setting in order. From measurement accuracy, work efficiency, work environment, etc., it is expected to implement the 3S (sorting, setting in order and standardizing) for IGB.

2) Aerial triangulation

To confirm the level of proficiency at the end of the training, the series of operations was performed again in the same area. Although in some areas incorrect selection when registering images, confirmation errors of the arrangement of tie points or the number of light rays, slack measurement accuracy, etc., was found, it was possible to evaluate that they had acquired the LPS workflow using ALOS images, and software operations from preparation of project files to evaluation of accuracy. On the other hand, there were differences between individuals in elementary areas such as familiarity with computer operations, which was seen as a difference in the level of proficiency. This is a problem that can be solved through the efforts of the individuals, and further training is expected.

Not only in aerial triangulation but in various cases those with more experience were the first to become proficient in the operations using the software, and it is necessary that more experience be accumulated in order to consolidate the technology acquired in the training.

For the pan sharpening process also it was confirmed that they were capable of carrying out the process on their own, although sometimes referring to the manual or memos. It is considered that this technology can be used for updating topographic maps by partial correction or in different operations.

3) Field identification/verification

In the technology transfer for photo interpretation and field identification, it was confirmed that the field identification capability of all the survey members was improved by lectures and practice. Because this survey method was completely different from conventional field identification, in particular in photo interpretation, they became able to distinguish items that could be interpreted photographically and items that are difficult by becoming familiar with the images.

The evaluation results for each objective are as follows.

- Improvement in the degree of understanding of the field identification procedures

  Understanding of the series of procedures of field identification was encouraged by explanation in the office. Also by repeated operation on site, each of the participants became capable of effectively applying the methods. This was particularly seen in confirmation of photographs taken, display of survey position on the photos, and determination of survey routes.

- Acquisition of basic skills in image interpretation and topographic map reading

  Differences in degree of proficiency in image interpretation and topographic map reading were recognized initially among individuals. However, as a result of repeated lectures and discussion, a uniform understanding was obtained for the degree of understanding of the application of map symbol rules and accuracy of planar interpretation such as vegetation boundaries, etc.

- Acquisition of efficient and effective survey procedures

  In image interpretation, the participants became familiar with satellite images, and became capable of distinguishing between map symbol items that can be interpreted and map symbol items that are difficult to interpret. Also, each of the members have become capable of defining survey routes to enable improvement in image interpretation capacity and efficient and effective survey of many survey items, and plans for the scope of surveying.

- Improvement in methods of displaying and arranging field identification results

Field identification results are displayed on images as point, linear, or planar objects corresponding to survey item type codes. The fundamental parts of this method of displaying were understood and implemented. However further improvement in the method of display and expression is necessary. Also it is desirable that the display of each member is uniform, and that the display takes into consideration the survey results of adjacent members, such as by adjoining the sheets of adjacent members.

4-1) Digital plotting

The Study Team decided to put the focus on the understanding by the trainee of software operation in the first phase and to explain logical check of data and selection of data for the digital plotting in accordance with the scale to be used. The Study Team identified the following problems in the outputs which the counterparts created without assistance in phase 1 and in the self-practice after the completion of the first phase:

i) The trainees made many line-connection errors.
ii) The trainees failed to perform edge matching between files. (Data of certain features were acquired twice.)
iii) The trainees did not acquire data in a way to facilitate the data structurization when they acquired the data.

Problems i) and iii), the instructor explained the error detection function and a method to correct data manually and the trainees practiced data correction in the second phase of the technology transfer. Many errors were detected in the practice. However, as what is important in learning software operation are repeated practices and recognition of the reasons to perform certain operation (use certain tools), the team expects the trainees to make good use of the experience in this technology transfer in their work in future.

Although there were some cases where data had been acquired in too small pieces and acquired elevation data were not accurate in the planimetric mapping, the team saw no significant problem with regard to the capacity in photo interpretation of the trainees. The trainees seemed to have interpreted types of vegetation, even vegetation that we, the Japanese, are not familiar with, with common understanding, in general, though there was slight difference among their interpretations.

Interpretation of elevation is a prerequisite technology for not only contour plotting but also planimetric plotting. Since the errors in the interpretation of elevation found in the planimetric plotting in the technology transfer were too small to affect accuracy of 1/50,000 maps, the instructor only mentioned to the trainees that they had made errors. Meanwhile, the Study Team would like them to realize that the errors at the same level will be problematic when they perform large-scale plotting in future.

Since only one of the trainees in this training had experience in contour plotting implemented in the second and subsequent phases of the technology transfer (because the other IGB technicians with experience in the plotting were not able to participate in the training because they had to participate in the field verification), the Study Team was unable to provide sufficient training. This was because trainees with no experience in plotting had to acquire technical capacity to interpret elevation accurately with practice of measuring the elevation control points at first and this process alone required a considerable amount of time. In addition, the study area was inappropriate for the training on interpretation of elevation because of its extremely flat terrain. As the instructor explained how to use TopoMouse and configuration of the software to the trainees and these subjects are described in the manual, they are expected to have little problem in manipulating the TopoMouse and software. Since it requires more training to master drawing of contours than to master planimetric plotting, those

trainees will have to continue their training under the instruction of IGB technicians with experience in plotting.

Interpretation of elevation is a fundamental part in not only contour plotting but also plotting with photogrammetry and stereoscopy and an essential part requiring a certain period of training. The Study Team hopes that the IGB staff members who had the first experience in plotting with stereoscopy in the project will have opportunities to practice the plotting and expects them to continue repeated practice voluntarily as the equipment used in the plotting is always available to them.

The training in the technology transfer on digital plotting was implemented simultaneously with the field verification. The training began with some uncertainties as some of the map symbol items had been modified. Because of these reasons, the Study Team was unable to provide sufficient training to the trainees in the technology transfer. This is the issue that the Study Team has to reflect on. The attitude of the trainees to the training was serious and they always took notes in the training. They also showed willingness to learn technologies in one way or another. Despite these observations, they seemed to be passive in general in the training. There is more than one method to achieve a goal and one has to have flexibility to use different methods under different requirements or for different purposes. One cannot describe the skill required for such flexible use of methods in a manual. A help manual attached to the software explains ways to use individual tools. The team considers that an effort to read and understand the manual is an absolute necessity for the trainees to master the skill and that they can do so only if they continue the effort. Therefore, the team hopes that they will make this effort.

4-2) Digital compilation

The trainees recognized the importance of the specifications in the map symbol rules in the creation of 1/50,000 digital topographic maps and also acquired capacity to perform technical work in the digital compilation in accordance with the specifications without problems. The latest version of the software used in this technology transfer has a function for logical check of data. The trainees acquired the technical capacity to perform a certain level of quality control of data using this function in the technology transfer.

The Study Team recognized in the technology transfer that the counterparts were very much interested in new technologies. It will take a certain amount of time for them to understand and digest new technologies and use them in the practical work. Although the instructor of the Study Team urged them to digest transferred technologies with repeated practices, they seemed to be considering that it was sufficient if they understood the technologies in theory. They seemed content when the instructor lent them manuals. The team expects them to review the work procedures in the digital compilation and implement the digital compilation more efficiently using the latest version of the software provided in this project.

5) GIS data structurization

The Study Team determined whether the trainees had obtained the level of technical capacity required

for structuring digital data with ArcGIS without assistance or not on the basis of the outputs of a pilot project of creating GIS data from a DGN file of topographic map data.

The technical contents of the pilot project were conversion of data in the commonly-used file formats, such as DGN, DWG, DXF and Shape, into future classes, data processing, construction of topology, detection and correction of errors, creation of layers and creation of map documents. The team confirmed that the trainees had learned these technologies on the basis of the results of the evaluation of the output of the pilot project which they implemented repeatedly. On the basis of this confirmation, the Study Team concludes that staff of IGB is able to create GIS data by structuring data with ArcGIS without assistance.

The Study Team confirmed that IGB had had a certain level of experience in using ArcGIS in the work before this project. However, the team also confirmed, at the stage of the practice of basic operation, that they had been using it mainly for a specific purpose of data creation operation (data digitization) without taking advantage of the features of ArcGIS. On the basis of the confirmation, the instructor taught the theories and methods to use tools of ArcGIS effectively and ways to improve efficiency of the work with the use of the tools. The implementation of this technology transfer reinforced trainees' understanding of structuring digital data with ArcGIS.

The trainees attended the technology transfer with a positive attitude and voluntarily asked questions on the points that they had failed to understand. The Study Team acknowledges that IGB selected ideal persons as the trainees of the transfer of GIS technologies.

It is regrettable that only a number smaller than expected of trainees participated in the technology transfer because some of the staff members supposed to participate in it had to take part in the survey of place names. However, those trainees who participated in the technology transfer improved their level of knowledge markedly in the technology transfer. The team expects improvement of the GIS capability of IGB as a whole from the training provided by the trainees to other IGB staff members.

6) Map symbolization

The Study Team determined whether the trainee had obtained the level of capacity required for the implementation of the map symbolization with Illustrator without assistance or not by observing her work in the process from the import of the actual data created in the digital compilation into Illustrator to the map symbolization.

The contents of the map symbolization implemented by the trainee for the evaluation were how to use Eyedropper Tool, patterns, symbols and brushes in Illustrator. The Study Team confirmed that the trainee improved her technical capacity and learned the technology while the trainee repeatedly practiced the task.

The instructor spent sufficient time to teach the trainee how to create symbols, patterns and brushes which are used as basic tools for the map symbolization. The Study Team evaluated the technical capacity of the trainee on this subject by giving her a test. In practice, the Study Team asked her to create certain symbols, patterns and brushes for the evaluation.

On the basis of the results of the evaluation by processes mentioned above, the Study Team concludes

that the trainee of IGB has acquired technical capacity to implement the map symbolization with Illustrator.

Because the trainee of the technology transfer on map symbolization had never used Illustrator, a vector graphics editor, before the transfer and it was fundamentally different from the CAD software, MicroStation, which she learned in the preceding technology transfer, she had difficulty in learning how to operate the software. Therefore, the instructor gave her a task of creating objects which were relatively easy to create, such as the logo of IGB, as a means for her to master basic operation of Illustrator before the transfer of the technologies used in the map symbolization.

The trainee participated in the technology transfer with a positive attitude, which was revealed in the fact that she always asked questions and took notes during the technology transfer. The selection of a woman as the trainee of the technology transfer on map symbolization is considered appropriate because map symbolization is a process to give appropriate appearance to topographic maps which requires meticulous attention of operators.

The fact that she was the only trainee seems to have resulted in turn in the implementation of detailed and content-rich technology transfer. The team expects that she will be able to improve her technical capacity further by teaching map symbolization to other IGB staff members.

Chapter 5 Reports

5.1 (2)Preparation of Inception Report (Work in Japan)

Based on the existing documents and collected documents, a preliminary study of the basic policies associated with implementing the work, work methods (including methods of technology transfer), details of work items, implementation system, schedule, etc., was carried out, and summarized in the Inception Report, which was approved by JICA.

5.2 (3)Explanation and Discussion of Inception Report (Work in Burkina Faso)

The Inception Report (draft) that was already approved by JICA was submitted to the Government of Burkina Faso, and the study details and implementation methods were explained to them. Also, details of the discussion were summarized in the minutes of meeting which was approved.

5.3 (12)Preparation of Interim Report (Work in Japan)

The Study Team prepared an Interim Report which described the work implemented by the end of November 2012, assessment of the outputs and strategies and schedule for the work to be implemented.

5.4 (13)Explanation and Discussions of Interim Report (Work in Burkina Faso)

"Explanation and Discussion of Interim Report" was held at the conference room of IGB in May 2013 as an occasion for the Study Team to explain to and discuss with the IGB side the details of the progress of the work up to the end of March 2013. Three senior officials of IGB, Mr. Tapsoba, the Director General, Mr. Compaore, the Project Manager, and Mr. Belem, the Director of Technical Department, and three members of the team, including an interpreter, participated in the explanation/discussion. The Study Team members used the Interim Report to explain progress of the work by the end of March 2013 by work stage, interim results of the study, results of the assessment of the interim results and strategies and schedule for the work to be implemented.

5.5 (20)Preparation and Explanation/Discussion of Draft Final Report (Work in Japan/Burkina Faso)

The Study Team prepared the Draft Final Report which described the progress of the entire project and its outputs. The team also compiled various work manuals to be used by IGB for development, maintenance and administration of various (geospatial information) data by themselves in future.

After having incorporated views of member experts expressed in the discussion meetings on the report held in Japan, the Study Team explained and held discussion on the Draft Final Report in Burkina Faso.

5.6 (21)Preparation of Final Report (Work in Japan)

The Study Team prepared the Final Report by revising the Draft Final Report in accordance with the

outcome of the discussion on it with the counterparts and adding the description of the work implemented after the discussion on the Draft Final Report (*e.g.* printing of topographic maps, technology transfer on website construction and promotion of data utilization).

Chapter 6 Other Work Implemented

6.1 Procurement of Equipment (Implemented by Study Team)

In the beginning of May 2012 equipment that was procured by the Study Team was delivered. This was used in the analysis of ground control point survey data, and confirmation of its operation has been completed. This equipment also includes items (UPS, large scale plotter) that are used in combination with the equipment delivered through an equipment tender organized by the JICA Burkina Faso Office. The following photographs show the equipment that was supplied.

Photo 6-1 Large format printer

Photo 6-2 Cartridges, paper rolls

Photo 6-3 Digital levels DNA10

Photo 6-4 UPS

Table 6-1 List of equipment supplied by the Study Team

No.	Item name	Quantity	Unit
1	Uninterruptible power supply	6	sets
2	A3 printer	2	sets
3	Printer cartridges	12	sets
		12	sets
		12	sets
		12	sets

4	Large format printer	1	set
5	Waterproof paper rolls	2	rolls
6	Paper rolls	5	rolls
7	Bond paper	5	rolls
8	Printer heads	6	sets
		6	sets
		6	sets
		6	sets
9	Maintenance cartridge	1	set
10	Printer cartridges	6	sets
		6	sets
		6	sets
		6	sets
		6	sets
		6	sets
11	LEICA digital levels	2	sets
12	Staffs	2	sets
13	Staff rods	2	sets
14	LGO analysis software	2	sets
15	LGO_CAD export MDL	2	sets
16	LGO_leveling results MDL	2	sets
17	LGO3DMDL	2	sets
18	LGO bundled communication programs	2	sets
19	OS for notebook PC	6	sets
20	Antivirus software	6	sets
21	Notebook PC	2	sets
22	Training program	1	set

6.2 Procurement of Equipment (Implemented by JICA)

Equipment procured by JICA was delivered in the middle of September, and the equipment underwent inspection for acceptance. The following is a list of the equipment procured.

Table 6-2 List of equipment procured by JICA

No.	Item name	Quantity	Unit
1	LPS CORE software for photogrammetry	3	Licenses
2	LPS STEREO software for stereoscopic viewing	3	Licenses
3	ORIMA/DP-TE/GPS software for aerial triangulation	1	Licenses
4	LPS Pro600 software for digital plotting	3	Licenses
5	LPS ATE software for preparation of DEMs	1	License
6	LPS TE DEM editing software	1	License
7	MicroStation V8i digital editing software	6	Licenses
8	Bentley Map V8i digital editing software	3	Licenses
9	Adobe Illustrator symbolization software	2	Licenses
10	ArcGIS Desktop GIS software	1	License
11	ArcGIS Desktop Extension Spatial Analyst GIS utilization software	1	License
12	ArcGIS Desktop Extension 3D Analyst ArcGIS GIS utilization software	1	License
13	ArcGIS Desktop Extension Network Analyst ArcGIS GIS utilization software	1	License
14	USB TopoMouse digital plotting mouse	3	Units
15	Planar SD2620 3D monitor for digital plotting	3	Units
16	Nvidia Quadro FX4800 graphics card for 3D monitor	3	Units
17	Adobe Photoshop image processing software	2	Licenses
18	Dell S2410w monitor	6	Units
19	Dell Precision T5500 desktop computer	6	Units

Chapter 7 Outputs

The reports submitted at each stage of the work are as follows.

7.1 Study Reports

Table 7-1 Study reports

No.	Report name	Volume in Japanese	Volume in English	Volume in French	Government of Burkina Faso	
					Volume in English	Volume in French
a	Inception Report	10	15	15	10	10
	Content	Plan for implementation of the project, such as basic policy of the project, methods, work schedule, personnel plan, implementation system, technology transfer plan, etc.				
	Time of submission	At the start of the project				
b	Interim Report	10	15	15	10	10
	Content	Survey results up to field identification, progress of technology transfer, subsequent plan				
	Time of submission	11 months after start of project				
c	Draft Final Report/main	―	15	15	10	10
	Summary	―	15	15	10	10
	Japanese summary	10	―	―	―	―
	Content	Total outputs of the project, technology transfer outputs, work manuals, quality management report, rules, etc.				
	Time of submission	22 months after start of project				
d	Final Report/main	―	15	15	10	10
	Summary	―	15	15	10	10
	Japanese summary	10	―	―	―	―
	Content	Total outputs of the project, technology transfer outputs, work manuals, quality management report, rules, etc. (final version)				
	Time of submission	Within 1 month of receiving the comments from the Burkina Faso side on the Draft Final Report				

7.2 Outputs to be delivered

The following outputs will be submitted to JICA. The numbers submitted are also as follows.

Table 7-2 Outputs

No.	Outputs	Unit	Quantity	Notes
a	Orthophotos	Set	1	1 set for the Government of Burkina Faso
b	Aerial photograph contact prints	Set	2	1 set for the Government of Burkina Faso
c	Site surveying results	Set	1	1 set for the Government of Burkina Faso
d	Aerial triangulation results	Set	1	1 set for the Government of Burkina Faso
e	Digital data files			
i)	1/50,000 topographic map data	Set	2	1 set for the Government of Burkina Faso
ii)	1/50,000 GIS basic data	Set	2	1 set for the Government of Burkina Faso
iii)	Final Report	Set	1	1 set for the Government of Burkina Faso
f	Output maps	Set	200	200 sets for the Government of Burkina Faso
g	Booklet	Set	100	A3 size (100 sets for the Government of Burkina Faso)
		Set	5	Master drawing size (3 sets for the Government of Burkina Faso)
h	Quality management report	Set	1	Instead of a review of the topographic map production process, a report on quality control by the contractor for this project will be submitted.
i	Technical specifications	Set	1	1 set for the Government of Burkina Faso

Chapter 8 Utilization of Digital Topographic Map Data in Burkina Faso and Recommendations

8.1 Utilization of Digital Topographic Map Data

8.1.1 Importance of Topographic Maps

Topographic maps contain various objectives, whose (1) distances, (2) areas, (3) directions and (4) topology are correctly represented in an easy-to-understand way. When a nation has emerged as a result of social development, topographic maps become an essential administrative tool for such activities as development of farmland and construction of irrigation channels. The central and local governments and private companies which intend to implement development projects need topographic maps which describe the latest conditions of project sites as indispensable basic materials, because it is difficult for them to prepare appropriate national land development plans without accurate topographic maps.

Unavailability of accurate topographic maps and delay in creation of topographic maps have been often cited as obstacles to development in developing countries in Africa and other areas. Topographic maps have contributed to development of nations in many areas, including development of infrastructure, agriculture, health and education sectors, reconstruction after disasters and forest and natural resource management, as basic reference materials.

For example, the topographic maps created with assistance from JICA have been utilized as foundation of national development on many occasions, including maintenance and management of urban infrastructure, urban planning and projects in the areas of food security and health. One of the more visible examples is that GIS based on topographic map data is constructed for the selection of sites for construction of schools and hospitals, and drilling sites of boreholes before the implementation of those construction projects.

In the area of people's life, the residential maps of Zenrin and Google Maps are widely used in many occasions in daily life in Japan. Google Maps and other similar applications are widely used largely because they are available on smartphones. In fact, these applications not only have a large number of users, but also are indispensable tools for users' daily lives. In this area, utilization of such applications is expanded by good public relations (advertising) activities, understanding needs in the everyday life of ordinary people.

8.1.2 Characteristics of the Recent Topographic Maps and Future of Topographic Maps

Transition from topographic maps on paper to digital topographic maps began in the 1990's. At present, all the maps found in everyday life are digital maps. All JICA's assistance has also been on topographic mapping in digital format since the latter half of the 1990's. This transition from paper to digital maps has created a large potential for utilization of topographic maps. In the era of paper

maps, creation and utilization of maps are mutually independent processes. Digitization of topographic maps has resulted in acceleration of the integration of creation and utilization of topographic map data, which is generally referred to as' provision of solution' with inclusion of solution in the area of positioning.

A wide variety of solutions utilizing topographic map data have already been on the market, including not only those for personal use such as automobile navigation systems and shop information search systems, but also those for the transport industry for the improvement of efficiency of physical distribution, locating airplanes and vessels, management of vehicles and facilities, etc.

Automatic sowing and fertilizer application systems with agricultural machinery equipped with GPS devices are widely used in the world. Some foreign companies offer services to track stolen vehicles with GPS devices. Remote-controlled operation of bulldozers equipped with GPS devices is widely used in civil works in Japan.

As above, extended use of positional information via topographic maps is continuously expected in a wide variety of areas including transport, robotics, agriculture, forestry and fisheries and disaster prevention. For example, use of GPS and positional information systems in forestry will enable collection of accurate forest information in the field and improve the efficiency of creating maps required for forest management. Use of radio-controlled helicopters equipped with GPS devices will enable quick and low-cost aerial photography of disaster-stricken areas.

Three-dimensional display of geospatial data created by combining digital topographic map data and elevation data and building data obtained from aerial photographs and satellite images is expected to become general in future. Excellent graphic representation of the 3D display is expected to extend the use geospatial data to a wide variety of areas including simulation of disasters such as landslides and floods and creation of 3D tourist information maps. In addition, full scale projects for creation and utilization of 3D geospatial information, such as trials of creating "highly-accurate 3D geospatial information" with mobile mapping systems (MMSs) using vehicles equipped with laser measuring apparatus have already been launched.

It is evident from the observations mentioned above that the area of utilization of geospatial information (topographic maps) with high-precision positional information will expand further and that such geospatial information will become part of social infrastructure both in developed and developing countries. Unfortunately, the general public is not much aware of the importance of such topographic map data. Since creation of topographic maps is expected to remain an important mission of a nation, creators of the digital topographic map data will have to meet the standards of accountability to the people fully. From this viewpoint, "activities to promote utilization of topographic map data" for the general public are an important and indispensable action.

8.1.3 Utilization and Promotion of Digital Topographic Map Data

In response to the importance of awareness creation activities mentioned above, the Study Team took the measures mentioned below on the utilization of and the creation of awareness to the digital topographic map data.

- Explanation on "A Story of Maps" and "Geospatial Information (Topographic Maps) in Future"

The Study Team held a meeting to explain "A Story of Maps," "Introduction to the Project" and "Geospatial Information (Topographic Maps) in Future" to approx. ten Japanese working in Burkina Faso, including the secretary in charge of mapping at the Embassy of Japan in Burkina Faso and the staff members concerned with the Mapping Project of JICA Burkina Faso Office (including the representatives in charge of the project including the Chief Representative, experts (in agriculture and fisheries), JOCV coordinators and JOCV members) as a measure to create awareness to geospatial information and promote its utilization in the activities of the Japanese working in Burkina Faso. (See (3) Holding of Meeting about Maps on page 67)

The Study Team had the impression that the participants of the meeting had understood the importance and usefulness of the geospatial information in the meeting. Therefore, the team expects extension of the awareness creation and the utilization in Burkina Faso by the Japanese through Burkinabés involved in Japanese technical cooperation.

- Implementation of user meeting

The Study Team held a user meeting for relevant organizations and people in Burkina Faso that are utilizing the data of IGB (mainly analog 1/50,000 topographic maps) in their official duties and notified them of the usefulness of the project outputs (digital topographic map data).

In addition, the team studied the current states of data utilization and specifications of digital data of user organizations by conducting questionnaire surveys and interview surveys and used the results of the surveys in the development of a system to provide output data on the website.

- Holding of a lecture tour

The Study Team conducted a lecture tour for pupils in the upper grades (fifth and sixth grade pupils) of elementary schools to draw their interest to topographic maps.

The team considers that drawing attention of pupils and students to surveying and topographic maps at the place of education will be a significant factor contributing to construction of sustainable geospatial information.

- Establishment of Rules on Utilization of Topographic Map Data

It is important to promote effective use of the data by promoting secondary use of the data among the general public. It is also important to establish rules (legal restrictions) on the secondary use of distributed data for data management including prevention of data falsification, because digital

data are particularly vulnerable to falsification. Therefore, the Study Team explained the importance of legal management of the secondary use to the senior staff members of IGB and recommended them to establish such rules urgently.

8.1.4 Recommendations on Activities to Promote Data Utilization

Based on the results of the project, the Study Team recommends the following practical awareness creation activities for the further promotion of data utilization:

1) To place importance on awareness creation activities in the plan for a national survey project which will be a guideline for the mapping organization
2) To prepare a short movie (on DVD) which explains roles of topographic maps in infrastructure development projects, characteristics of topographic maps, outline of the process of map creation and how to read topographic maps
3) To distribute copies of the created DVD to various public and educational institutions and collect information on the needs for the maps from them after the distribution
4) To promote development of an environment enabling users to obtain data easily and quickly (data provision through the website)
5) To improve people's awareness of topographic maps by offering the general public opportunities to see inside the mapping organization

8.2 Problems in and Recommendations for Technology Transfer

The purpose of the technology transfer was to equip the counterparts with capacity to create topographic maps unassisted in future. The Study Team set the target at the level of Japanese topographic maps for this technology transfer. Problems recognized by the Study Team during the technology transfer and recommendations for improvement in future are as follows:

8.2.1 Problems in Technology Transfer

《Technical capacity》

- Lack of basic technical capacity and knowledge

  The counterparts did not have sufficient knowledge of the work rules for the creation of 1/50,000 topographic maps. They seemed to consider creation of all different kinds of topographic maps as a single type of work and applied the specifications which should be applied to 1/5,000 and 1/10,000 topographic maps to 1/50,000 topographic maps. Lessons on plotting and compilation work had been provided to them before they had grasped basic knowledge required to understand the lessons. They seemed to have mistakenly believed that they had understood plotting and compilation work in its entirety by just mastering operation of software. The Study Team assumed that the counterparts had certain levels of knowledge and technical experience in GIS and website creation when they prepared the original plan for the technology transfer in this study. However, in reality, the team had to begin the technology transfer from the introductory level.

《Organizational structure and system》

- The proportion of engineers who continue to work at the NGOs is low

  There have been cases where highly educated young technicians have found new jobs elsewhere after having participated in OJT for the technology transfer and, thus, the efforts made to transfer technology to them have been wasted. Motivation to take up a new job for those technicians is always simple, expectation for higher salaries in a short period of time.

- Information is not shared within the organizations

  It seems that technicians who have had training in foreign countries do not share the technologies that they have learned in the training with other technicians in IGB. This conduct is against the principle of information sharing and there is a risk that such conduct may degrade the technical capacity of IGB.

  - The following are the reasons for the lack of information sharing:
    - Staff members of IGB are not so interested in sharing information which could lead to improvement of technical capacity with colleges and subordinates in the work place.
    - Since knowledge of a person is considered as a personal asset, those who have participated in Training in Japan do not extend the technical knowledge they have acquired in Japan to their colleagues or the colleagues do not ask for sharing of the

knowledge.

- The senior officials of IGB are not well aware of the importance of the information sharing.

➢ The following are the measures against the lack of the information sharing:

- Those who have participated in Training in Japan are made sure to hold reporting meetings after returning home.
  If a Japanese expert is in an NMO, he could make sure that such a meeting is held. However, it will be difficult to make sure that such a meeting is held in NMOs where there is no Japanese expert.
- The importance of the technology sharing shall be emphasized in Training in Japan.
  Those who have participated in Training in Japan are made sure to present action plans after returning home. They require monitoring and support for such an activity.

- <u>There is no mechanism to transfer and improve technical capacity</u>
  The Study Team assumes that presentation of practical benefits of newly-acquired technology through establishment and operation of a system to present, review and evaluate the new technologies and their outputs leads to technology succession. Therefore, it is necessary to swiftly establish such a system in IGB.

《Work ethics》

- <u>Necessity of awareness to the improvement of working environment is low</u>
  In developed and newly developed countries, the 4S (*seiri, seiton, seisou and seiketsu,* the Japanese words for orderliness, tidiness, cleaning and cleanliness, respectively) activities are practiced in workplaces for organizational reform and improvement of productivity. Some countries and organizations further advanced the activities to 5S (adding *shitsuke* (discipline) to the previous four) activities.
  Meanwhile, the IGB technicians do not seem able to maintain orderliness and tidiness of their workplaces very much. For example, a Study Team member found a tripod for ground survey just lay on the floor of the room where maps were to be created with precision equipment. Team members often found the counterparts unable to locate their observation field books when they were required for the GNSS analysis calculation. Even after a Study Team member had taught the counterparts a basic filing method (filing data in a chronological order) by practicing it, they were unable to implement it.

- <u>Planning and punctuality</u>
  While working together, the Study Team found that counterpart engineers tend to be negligent of time, promises and plans. Work plans prepared by them tend to be unrealistic and work implemented with such plans often produces outputs quite different from those assumed in the plans. Therefore, they seem to waste time and money on reconciling this difference. On the

basis of this observation, the Study Team considers that "observance of rules" is a very important precondition for the development of IGB. Capacity of the counterparts in preparation of plans seems to be necessary.

《Project implementation and management》

- Replacement of trainees occurs frequently

  Illness, childbirth and job changes were among the reasons cited for the change of trainees. Frequent change of trainees in the technology transfer delayed the progress of the work. It is important to take all possible measures to implement technology transfer with the fewest possible changes of trainees in order to maintain their motivation to participate in the topographic map data creation and to prevent loss of transferred technologies.

8.2.2 Recommendations on Technology Transfer

《Technical capacity》

- Implementation of a technical cooperation project

  The lack of basic technical capacity and knowledge of the staff of IGB was revealed in this study. Therefore, implementation of a technical cooperation project focused on the technology transfer similar to the one implemented in this study will be required for them to create and maintain topographic maps independently. The implementation of such a project will be important for a wider area because of its contribution to the strengthening of organizational capacity of the national mapping organizations (NMOs) in West Africa where many cooperation projects in topographic mapping have been implemented in recent years.

  It has been mentioned in this report that Technical Seminar for Wide-Area Collaboration was held in Burkina Faso for the purpose of establishing collaboration among West African nations led by IGB for continuous and sustainable creation of geospatial information by IGB and in West Africa where Burkina Faso is located. This seminar was held in Burkina Faso because IGB was the leading institution in the area with regard to technologies to create topographic maps. Representatives of the member countries of UEMOA (West African Economic and Monetary Union) and NMO (National Mapping Organization) of Guinea were invited to attend the seminar held in Ouagadougou. They were expected to share problems in their organizations and measures taken against them in the seminar. This was because the UEMOA member countries which face many problems are believed to easily find solutions to problems by developing countermeasures against those problems jointly, instead of tackling them independently.

  Therefore, provision of technical cooperation to IGB is expected to contribute to the improvement of technical and organizational capacity of NMO's in West Africa, among which IGB is regarded as a leading organization. In addition, further significance may be added to the assistance provided so far in West Africa by JICA, with implementation of technical

cooperation with such a wide-area perspective.

The Study Team recommends technology transfer as the form of a technical cooperation project in future. Unfortunately, the team has concluded that the technical capacity of IGB has not reached the level at which it can carry out topographic mapping from the planning stage independently, as mentioned elsewhere in this report. Therefore, the following are recommended as contents of the project of technology transfer in a wide sense, which is intended for complete mastery of the technology for topographic map data creation by counterparts:

- As one of the programs in the project, a long-term expert shall be dispatched (as a supervisory advisor) to Burkina Faso intermittently for a period of two years.
- Engineers for the technology transfer shall be dispatched to Burkina Faso (as short-term experts) intermittently with each dispatched for a period of two months in a period of two years.
- The counterpart engineers of IGB shall be trained so that they shall have the technical capacity to serve as instructors of Training in Third Country for engineers of the NMOs of the other UEMOA member countries at the completion of the project.

The project shall include content related to the UEMOA seminars (inclusion of a seminar or workshop intended as a follow-up to the two seminars so far conducted in the technical cooperation project) for identification of a new project (which may be a pilot project).

《Organizational structure and system》

- <u>Improvement in proportion of technicians who continue to work at IGB</u>

  i) Improvement of motivation

  IGB shall prepare programs which can improve the motivation of its technicians. For example, IGB has to make its technicians recognize again that the data in the national base maps created by IGB can be a basis of infrastructure development in Burkina Faso. The Study Team has observed that IGB has not recognized this fact.

  ii) Effective reassignment of personnel

  Many technicians have worked at the same departments for a long period of time. IGB should take measures to improve motivation of technicians such as opportunity to acquire other technical skills by exchanging technicians, for example, between the Survey Division and Geospatial Information Division.

  iii) Review of remunerations

  Although the Study Team has no right to comment on working conditions of public service personnel in Burkina Faso, the team considers it necessary to increase salaries of IGB employees even by small amounts under certain circumstances.

  iv) Participation in training of choice

  Opportunities for technicians to participate in technical training in developed countries such

as Nigeria, the Netherlands, France and Japan, shall be increased.

- Information sharing shall be facilitated for transfer and improvement of technical capacity

  i) Equal opportunities to participate in technical training

  IGB employees shall have equal opportunities to participate in technical training with regard to what has been mentioned above. (No employee shall have more training opportunities than other employees.)

  ii) Frequent in-house reporting meetings with presentations by those who have completed training courses

  Since new technologies acquired by certain technicians of IGB should be considered as properties of the entire IGB, it is essential to have such meetings frequently.

  iii) Establishment of a permanent project implementation structure

  IGB has to change the attitude from waiting for assistance from donor countries and organizations to attempting to implement projects with self-help effort. For this attitude change, IGB must prepare plans for projects to be implemented immediately and in future.

  iv) Establishment of a closely-connected information network with countries in the area

  IGB has to implement projects while sharing the information on problems and measures taken against them identified and discussed in the Technical Seminar for Wide-Area Collaboration with countries in the area.

《Work ethics》

- Awareness to comfortable working environment shall be enhanced

  Training courses conducted in Japan should include an opportunity for participants to learn 4S or similar activities. Those who have participated in such courses are expected to be able to behave somewhat differently from the way they used to on all matters, though it may take a long period for them to do so. This behavioral change is expected to contribute significantly to improvement of the quality of products and productivity. However, the Study Team considers that long-term, five-year or 10-year-long, training is required for such improvement (change in attitudes).

- Observance of rules

  The Study Team recognizes a need to introduce a time-card system and recommends it as a means to enhance planning capacities and awareness of punctuality. The team expects IGB to self-improve discipline by nurturing the culture of punctuality and efficient time management.

《Project implementation and management》

- Creation of good environment at places of work

  An advantage of the French scheme is that a wide variety of material assistance enhances motivation of participants of the project. However, it seems that this advantage does not

necessarily help Burkina Faso, as an independent country, achieve its goal of self-reliant topographic map creation (by IGB). Meanwhile, the team considers that the Japanese scheme should allow inclusion of a certain level of assistance to improve work environment, such as provision of desks and chairs appropriate for operation of computers to be provided, in technical cooperation in order to motivate counterpart technicians.

- Fixed trainees

  The Study Team recommends that the number of trainees should be decided in proportion to the number of copies of software and that of pieces of hardware. The technology transfer on some subjects had only one trainee in this project. It might be possible for trainees who benefited from such content-rich technology transfer implemented in sufficient time to teach the technologies learned in the technology transfer to other trainees.

- Firm decision-making

  The Study Team recommends that managerial personnel should be trained to assume responsibilities attached to their positions. They should learn that progress of work will be delayed significantly if they change orders frequently. IGB should train them to fulfill their responsibilities.

8.2.3 Remarks on Technology Transfer

Quality of outputs of the technology transfer was good while experts in the Study Team are in Burkina Faso, for obvious reason. However, the Study Team members have learned from their experience that the counterpart technicians will not be able to do anything against unexpected technical problems which occur while they are using the transferred technologies by themselves after the scheduled technology transfer program has been completed and the Japanese experts have gone back to Japan. The time allocated to the technology transfer in this project was too short to expect the counterparts to master the transferred technologies. People usually master technologies by practicing them repeatedly for a long period of time. They are likely to encounter various obstacles and problems during the course of mastering technologies. The Study Team consider that "transfer of technologies should be considered completed" only after the counterparts have encountered all those obstacles and problems and solved them by themselves.

At present, the Study Team considers it impossible to raise the technical capacity of the counterparts to the target level in such short technology transfer. The technology transfer in this project should be considered as the first step in the process of raising the level of technology transfer to the target level. Therefore, what is important in this stage is to search appropriate ways to transfer technologies and let the counterparts master the technologies transferred so far.

To ensure that the counterparts to attain the target level, the Study Team considers two aspects of the technology transfer, namely, in a narrow sense and in a wide sense.

The team considers that technology transfer in the narrow sense implies technology transfer focused

on technologies used in specific stages of the work, *e.g.* GNSS observation, analysis of GNSS observation data, compilation of the analysis results, field identification, plotting with satellite images, map compilation and printing.

Technology transfer in the wide sense implies not only transfer of practical technologies, but also technology transfer in a much wider perspective including technology transfer on maintenance of equipment, necessity for work planning and maintenance of planning and work environments and what can be referred to as creation of a foundation enabling technology transfer which includes changes in attitudes and long-held traditional behaviors based on local environments.

It is thought that it takes at least two years to make counterparts master technologies to their full potential even in the case of the technology transfer in the narrow sense. It is considered that dispatch of experts for a long period of time, at least 10 years and probably longer, will be required for the technology transfer in the wide sense. Of course, the Study Team has experience in implementing technology transfer in other countries where it did not take such a long period of time to complete it. Nonetheless, the Study Team considers long-term continuous technical cooperation necessary for African countries, regards topographic maps as infrastructure for infrastructure development and believes that they are indispensable in national development as basic information/tools.

With recognition of the need for measures to develop technology transfer into the one in the wide sense at an opportune moment in the technology transfer with improvement of work environment and dissemination of knowledge in lectures, the Study Team earnestly requests continuation of the technology transfer in future.